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ABSTRACT

The environmental education activities package for grades 6-8 contains activities in the following curriculum areas: (1) social science; (2) science; (3) language arts; and (4) mathematics. The activities are divided into seven sections based on seven environmental topics: (1) ecosystems; (2) population; (3) energy and resources; (4) economics, technology and culture; (5) environmental quality; (6) environmental policy; and (7) environmental ethics. Each activity gives the curriculum topic, the environmental topic, a list of skills exercised in the activity, the subject, grade level, the location necessary to carry out the activity, the author, the objective, background information for the teacher, materials, a vocabulary list, and some related activities and resources. (BB)

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EARTHWATCH

Designing Environmental

Education

in the Curriculum
Grades 6-8

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
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SE 027 630

ENVIRONMENTAL EDUCATION
CENTER

A PROGRAM OF AREA COOPERATIVE EDUCATIONAL SERVICES

ENVIRONMENTAL EDUCATION CENTER

a program of Area Cooperative Educational Services (ACES)

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EARTHWATCH

DESIGNING ENVIRONMENTAL EDUCATION INTO THE CURRICULUM

VOLUME II

grades 6 - 8

produced by

Environmental Education Center

a program of Area Cooperative Education Services

Editors

Larry Schaefer

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**To The Children
may their world be full**

INTRODUCTION

"My interest is in the future, because I am going to spend the rest of my life there."

-- C. F. Kettering

Due to national and international developments during the 1960's such as deterioration of air and water quality, soaring gasoline prices, contaminated drinking water, and depletion of natural resources, educators came to realize the need for introducing students to relevant concepts directly related to environmental issues. Striving to serve the needs of society, a new dimension called "environmental education" evolved during the latter part of the decade. Most educators agreed that environmental education should be dedicated to producing environmentally literate citizens. In other words, such a process should produce citizens equipped with factual and unbiased information concerning the basic ecological systems, skilled in problem-solving and decision-making and motivated to take an active role in working toward the maintenance of an ecologically-sound environment.

The ultimate objective of involvement in an environmental learning program is to enable people to think reasonably and thoughtfully about their environment. This will come about through specific and continued experiences with their environment. Any single experience is not enough. In time, experiences will accumulate to the extent that students can visualize patterns and causes and effects which make sense to them and which relate to other aspects of life.

In order to reach this goal, it is important that students have environmental learning experiences on a continuing basis throughout their lives. There are basically two approaches to implementing environmental education to reach this goal:

1. Environmental education uses the skills and information of various disciplines.
2. Each discipline can use environmental activities to teach the knowledge and skills of that discipline.

The problem of the first approach is that if we continue to "take time out" from the everyday instructional program to deal with environmental problems, they will remain adjunct concerns. In addition, there is always the problem of one more unit in an already crowded program. On the other hand, if we prepare a program of instruction which is customized with or has environmental objectives built in, our attention to such concerns will be as regular and automatic as the social occurrence of the problems themselves. It is this second alternative that has been developed in this notebook of activities.

Infusion is not a new concept. It is in fact an integral part of the entire education process. Every teacher strives to integrate and piece together for their students the many topics, subjects and categories that divide the school day. Writing skills are not isolated exercises to be performed during an English lesson but are important tools of communication in science, social studies and the language arts.

Our Environmental Education Infusion Project is a two-fold response to this aspect of the teaching process. In response to the crowded curriculum, the infusion approach frees a teacher to environmentalize their classroom to any extent. By selecting one or more EE infusion activities, a teacher can highlight the environment in key spots throughout the school year. And perhaps more importantly, by integrating environmental education into a multitude of disciplines and topic areas, the students' thinking comes to reflect an environmental ethic which spans the individual curriculum topics. Rather than viewing environmental education as a day to collect litter or as a bulletin board of pollution posters, students begin to apply their environmental awareness and knowledge in all their classroom activities and investigations.

The primary objective of the EEC Infusion Project was to closely link participating school district curriculums to opportunities in environmental education. These opportunities were identified by the EEC staff using school district curriculum guides and the EEC resource library and were integrated into a giant matrix. The horizontal axis recorded the sixty-five science and social studies curriculum topics gleaned from a careful analysis of school programs. The vertical axis, a framework for environmental education, was conveniently divided into seven major topics: Ecosystems, Population-People, Resources-Energy, Environmental Policy, Environmental Ethics, Environmental Quality and Economics, Technology and Culture. Using the matrix as a guideline, the two writing teams worked diligently to create and rework curriculum activities to highlight the environmental issues which emerged from these curriculum areas. The teams were teachers from participating school districts, Amity, East Haven, Stratford and Westport, as well as several other teachers who joined forces for an intensive period of curriculum writing. Ideas were formulated during team brainstorming sessions and writers cooperated to improve the quality of one another's work. The final products, two activity notebooks (one, grades 3-5 and the other grades 6-8) are titled Earthwatch.

Although this approach to the development of curriculum materials seems long and complex, it is based on the belief that by incorporating environmental education concepts into an on-going curriculum several benefits can be derived. First, continuation of environmental education instruction can be assured, without the necessity of massive external funding sources. Second, by incorporating these concepts at appropriate places in many areas of study, environmental education can remain dispersed throughout the curriculum and not become a specific entity or source that should be taught at a certain grade level. This allows students to be introduced to environmental materials at all grade levels and in almost all subject areas in a subtle, yet reinforcing manner, assuring the transdisciplinary nature of environmental education. Third, by allowing teachers to introduce environmental concepts within the framework of the courses they are already teaching, their confidence in themselves and the materials can be maintained, and the need for extensive teacher in-service training can be kept to a minimum.

We understand learning to be a change in either behavior or in pattern of thinking which follows upon an accumulation of experience. Infusing environmental education into a variety of subjects and grades can provide the diversity of experiences for environmental learning while preserving the integral fabric of a curriculum designed to develop specific skills and content.

USER'S GUIDE

FINDING AN ACTIVITY

There are three procedures which may be used to utilize this notebook.

Option I

Turn to the list of curriculum topics in the Table of Contents on page viii. These curriculum topics are listed by discipline - social studies or science (additional disciplines may also appear). Choose an appropriate curriculum topic. After each curriculum topic are page numbers to identify activities which teach that topic.

Option II

Turn to the subject index at the end of the notebook. The index provides access to activities based on key words which best describe each activity. The appropriate page numbers follow each key word.

Option III

The activities are divided into seven sections based on seven environmental topics: (1) ecosystems (2) population (3) energy - resources (4) economics, technology and culture (5) environmental quality (6) environmental policy and (7) environmental ethics. Immediately following each environmental division in the notebook, there is a table of contents which lists the activities in that section by descriptive title and page number.

READING THE ACTIVITY

Each activity has an identical format. The most obvious section is the introductory box containing the Curriculum Topic (from your school district program) and the Environmental Topic around which the activity was designed. To enhance your reading of the activities, each section of the activity format is described on the following mock-up of the activity.



Curriculum Topic as indicated.

Environmental Topic one of seven environmental topics.

Skills skills exercised in the activity selected from the Taxonomy of Skills (See Appendix).

Subject as indicated.

Grade Level(s) as indicated.

Site location necessary to carry out activity.

Author name of teacher designer.

Objective desired outcome in the learner following completion of the activity.

To The Teacher substantive information to: 1) provide background for the presentation of the environmental topic; 2) explain the connection between the curriculum topic and environmental topic.

Before You Begin preparations, materials, and cautions to consider before implementing the activity.

Words To Know a list of key terms for the student (vocabulary).

ACTIVITY as focal point of the activity, this section contains the step-by-step procedure for carrying out the activity.

Related Activities various related activities as ideas for subsequent lesson plans and follow-up.

Resources references used in developing the activity. The EEC# found at the end of a citation refers to a catalog number for the material at the Environmental Education Resource Library.

Credit a source or person who made a significant contribution to the activity.

Notes To Myself an empty section to be filled out by you. It is a place to make notes regarding your individual use of the activity.

STUDENT PAGE pages referred to in the activity which can be duplicated and used by students for completion of the activity.

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INTRODUCTION TO ENVIRONMENTAL TOPICS

Accept this simple challenge: look around you, and name three things that are not part of your environment. The task, of course, is impossible. In its broadest sense, environment includes everything.

Yet environmental education cannot include everything. And while it cannot supplant such programs as outdoor education, or traditional disciplines such as biology or economics, neither can it accept the narrow focus of these subjects. Environmental education must be holistic without being overwhelming. To satisfy the human urge for simplification and classification, the Project Team has developed a conceptual scheme designed to encompass, in seven areas, the rubric "environment". The seven taxa are: Eco-systems; Population--People; Energy--Resources; Economics and Technology--Culture; Environmental Quality; Environmental Policy; Environmental Ethics.

While preparing the notebook, it became apparent that the writers tended to approach the environmental topics in two distinct clusters. The first set, Ecosystems; Population--People, and Energy--Resources represent constraints, the ecological boundaries within which environmental decisions must be made. They are the stimuli to a set of responses: Environmental Ethics and Environmental Policy which combine to determine our Environmental Quality. Economics, Technology and Culture are collectively the intersection of these two sets, for while they are in many ways determinants of our behavior they are also subject to resolute alteration.

The stimulus-response distinction is, of course, blurred. Energy may be a constraint within which we work, but conscious decisions can alleviate that constraint. This sort of interaction, however, precisely illustrates the first principle of environmental thought: everything is connected to everything else. So, even though our search for comprehensibility in the vastness of an interconnected universe leads us to classify and divide, the unity of environment remains. There can be no understanding of Ecosystems without understanding Environmental Ethics. No Environmental Policy fails to affect concerns expressed in the six other topics. World-wide banning of DDT, for instance, would drastically alter the balance between insects and their predators in the ecosystem (to the benefit of the predators!), affect efforts to reduce the mortality of human populations via mosquito control, change the inputs in agricultural production, alter the structure of demand for petrochemicals, reduce the level of toxic substances in the environment, and hopefully teach us a lesson about the unforeseen consequences of hasty action. Which of the seven topics could a discussion about a ban of DDT conceivably be limited to? Obviously, it encompasses them all.

We feel that there is a logic and consistency to our framework. We recognize also that any number of topical divisions are acceptable. Our point in presenting environmental education in arbitrary slices is to help focus your thoughts. We hope it does not narrow them.

ECOSYSTEMS



ECOSYSTEMS

<u>ACTIVITY TITLE</u>	<u>PAGE NUMBER</u>
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ECOSYSTEMS

As any living thing struggles to provide itself with the basic requisites of life--food, a place to live and bear young, a mate--it inevitably comes into contact with other living things. The different ways in which animals and plants interact with one another are innumerable.

These ecological relationships do not occur in a vacuum. They take place in a physical and chemical environment. This environment includes the oxygen and carbon dioxide in the atmosphere, water, inorganic minerals, and organic matter produced by the metabolism of living organisms and the decay of dead ones. It also includes physical properties such as moisture, wind, temperature, currents, and solar radiation. This physical-chemical (abiotic) environment and the living things (biota) that act within it comprise an ecosystem. "Ecosystems are real--like a pond, or a field, a forest, an ocean, or even an aquarium; they are also abstract in the sense of being conceptual schemes developed from a knowledge of real systems. In spite of the great diversity in types of actual ecosystems--from small to large, terrestrial to aquatic, laboratory to field--and in spite of the unique combinations of particular abiotic and biotic components in any particular one, there are certain general structural and functional attributes that are recognizable and to which attention can be directed." (Kormondy) One way of looking at ecosystems is to consider four of those major and universal attributes: limits, cycles, change, and interdependence.

Each ecosystem, even the global ecosystem, is limited. That is, there are only so many organisms an ecosystem can continue to feed and house. It takes the absence of only one particular environmental factor to become a limiting factor and life in the ecosystem is threatened. For example, the inability of sunlight to penetrate many feet of water limits the algal productivity of the deep sea no matter what the quantity of other key components. In functioning ecosystems, the biotic and abiotic components combine to set up a carrying capacity which determines the number of individuals the ecosystem can support.

The most pressing need of any organisms is to feed itself. Plants accomplish this by harnessing solar energy to build carbohydrates and other complex organic compounds. This process converts the sun's energy to chemical energy which the plant can then utilize for its growth, maintenance and reproduction. The ability of plants to use the sun's energy directly earns them the title producers. Animals, however, have no such ability. They must consume other living things to gain access to the sun's energy; hence the name consumers. Consumers--that is, they may be herbivores or carnivores. At each level of feeding along this food chain, however, there are losses--for instance, the loss of the energy stored in organisms which die and are not eaten and the inevitable energy loss which accompany the energy transfer at each feeding level. Ecologists have in fact measured these losses, which amount to about 90% at each step of the food chain. Thus the snake which ate the frog which ate the insect which ate the plant contains only about one-tenth of one percent of the energy originally present in the plants, which is why

most food chains are no longer than four steps. Of course, since most animals eat more than one kind of food, there are many food chains in each ecosystem. By picturing the many predator/prey relationships in the ecosystem, the linked food chains are seen to form food webs which represent a richer picture of the ecosystem. The entire ecosystem is, of course, limited by the primary productivity of its plants, and the flow of energy in the system is unidirectional, from the sun to the plants through the food chain and then lost to the environment in a less useful form, heat.

But while energy flow is unidirectional, the flow of material in an ecosystem is cyclical. If the elements and compounds which make up organisms were forever bound up in those organisms upon death, the world would soon contain nothing but dead bodies. Dead plants and animals in fact decay, and the vital ecological role of decay is performed by bacteria, fungi, and other micro-organisms known collectively as decomposers. Decomposition reduces large organic molecules to simpler elements and compounds, freeing them for use by living organisms. As a simple example, the decomposition of dead plants on the forest floor provides soil nutrients for the new generation of plants.

Cycles are then convenient natural housekeepers and essential environmental organizers. Generally these cycles include both geological and biological parts. For instance, carbon as it moves through its cycle, passes through the food chain via green plants during photosynthesis and animals during respiration, and is occasionally stored in large quantities in the earth as fossil fuels. Humans are part of these natural cycles, and their technology often influences the cycling of materials to a far greater extent than necessary. It is the responsibility of humanity to avoid impairing the functioning of these natural cycles, or its dependence on the natural world will be dramatically and catastrophically demonstrated.

The cycles of the world continue in a seeming equilibrium. But in fact many of these cycles are undergoing continuous almost imperceptible change. Change--constant, significant, and often (though not always) directional--is a fundamental fact of life. No ecosystem is ever static. Animals and plants are dying or beginning life. Metabolic processes that keep organisms alive are ensuring a constant flow of material and energy.

In many ecosystems these changes tend to produce a sort of evolution called succession. Succession is a series of environmental changes which are caused by biological agents. For instance, in a pine forest, the ground is heavily shaded. Pine seedlings do not survive well under such conditions, but the seedlings of such trees as maples, oaks and beeches thrive. Over time, the densely shaded pine forest sows the seeds of its own destruction, and is replaced by a shade loving oak-hickory forest. This oak-hickory forest, called a climax ecosystem, seems to endure without significant alteration. But the climax is in fact a temporary plateau. In time, a fire or landslide or some other abiotic environmental change will inevitably occur and start the process all over again. Nothing in the environment is forever.

Even the nature of the organisms which inhabit an environment change over time. It takes eons, but gradually the pressures of competition and a changing environment favoring those individuals with the proper adaptations, alter the genetic composition of species. The theory of evolution is by now so well-known in at least its basic form that it would be inappropriate to restate it here. But the importance for ecology is that organisms well adapted to their environment represent the cumulative effect of ecological pressures over a long period of time. If eagles evolve sharp talons with which to catch prey, it is only because those eagles which, at some distant time in the past, lacked talons were unsuccessful predators and died.

Of course, if it were not for the rabbits, rodents, and other prey the eagles catch, there would be no eagles at all. And that brings us to the fourth fundamental characteristic of ecosystems to be discussed: interdependence. Every species--every species, including humanity--is dependent upon all other living things and the unliving components of the environment. Humankind could not survive without green plants, because there would be no oxygen to breathe without plants. Without birds to eat the insects there would be no forests. Man's interventions in the natural world have often failed to consider the connectiveness of the ecosystem. We thought we could control the insects better with pesticides than the birds could do naturally--and now we each carry a load of DDT in our bodies, and are returning to natural means to protect our crops and woodlands. We felt that we could achieve the good life by using the fossil fuels and are now struggling to stretch for a few more years the supply of energy that nature stored over the course of millions of years. The time has come when each action humanity takes must be considered carefully in light of its impact on the global ecosystem--for the evolutionary response of organisms to environmental change that is too rapid is still as it was for the dinosaurs, extinction.

If you carry nothing else from this survey of ecosystems, remember this: "Thou canst not stir a flower without troubling a star." Far more important than memorizing words like trophic level, species diversity, or plant association is developing an ecological way of thought. That thinking process begins when you ask, "What will happen if...", when you insist on seeing the whole picture, when you ask "Why is it that way?" In an age of specialization, those who look for relationships, patterns, and concepts enjoy a view from a height.

-Steve Gold

E. J. Kormondy, Concepts of Ecology, 1969, Prentice-Hall, Inc.
New Jersey.

Exploration Application: Where I Go & What I Need

Curriculum Topic

AGE OF EXPLORATION, COLONIZATION,
GEOGRAPHY

Subject

Social Studies

Environmental Topic

ECOSYSTEMS

Grade Level(s)

6 - 8

Site

Classroom

Skills

Organizing information, identifying alternatives, map skills, writing

Author

Ed Lisk
Robert Slie

Objective

Students will be able to:

1. analyze different environments to help them
2. compute a list of items necessary for survival in a new environment.
3. they will also be able to complete and file an application/contract for journey of exploration
4. establish a chain of command



To The Teacher

It has been said by anthropologists that the agricultural potentiality of an environment determines the nature of the culture occupying it and the level to which that culture develops. The Phoenicians became adventuring sea farers when the limited resources of their land led them to the sea. Today Southern Europeans are often said to be more demonstrative - like the land "warmer" - than Northern Europeans. In primitive (as defined anthropologically) cultures, the relationship between environment and culture is more readily apparent to us. It is, for example, easy to find elements of Eskimo culture which have been developed for the particular purpose of coping with the harsh climatic conditions of the Arctic. Clothes made of thick furs, for example, are very well adapted to the needs of survival in a region of frost and ice.

This activity addresses the interrelatedness of asking students to consider environment and culture in different time periods and to propose ways and means of establishing new cultures in them. Because students will be expected to assume roles as explorers and colonizers, the activity will be more effectively implemented if they have read and discussed an account of experiences known to real explorers. Such accounts are found in the descriptive materials in chapter 4, Enjoying World History, Abraham and Pfeffer, and Part 5, Chapters 1,2,3, The Age of Europe, Scholastic World History Program.

Before You Begin

compose and make copies of the Exploration Contract (student page included here)

Words To Know

discover, explore, contract, apply, finance, voyage, expedition, departure, destination, vessel, justify, chain of command, crew, first-mate, tropical, survival

ACTIVITY

1. Divide the class into groups of 4 or 5. Assign each of these groups to act as one of the exploring nations from the age of exploration (England, France, Spain, Portugal, Holland). Explain that each will soon be leaving for the New World and preparations must be made.
2. If material has not already been covered in class, names of monarchs and areas explored in the "New World" by each of these countries should be learned by the class. Individual groups should know the names of their monarchs and the areas to which they will be traveling.
3. Familiarize students with differences in the geography and climate of the areas they will be exploring and colonizing. Students themselves may research these differences in their groups.
4. Hand out copies of the Contract for Journey Exploration. (Student page). Each group must complete one and return for approval by the monarch. (You may indicate acceptance of the application with a stamped seal of approval.)
5. In preparation for their trips of exploration and colonization, groups must consider and list all the items necessary not only to make the transatlantic voyage, but also to set up homes and survive in a new world. Explain that they will be leaving in ships and will not be able to buy anything after leaving home port.
6. Each group thereupon presents its list of necessary items to the class. Members of the group should be able to explain the necessity for each item. Lists should be written on the blackboard.
7. The class should suggest items forgotten on each list.
8. When lists have been compiled, similarities and differences can be discussed by way of discussing differences in the new environments.
9. Finally, acting as captain, inform groups that the ships will not hold everything they have listed. At 25% cutback is necessary to avoid overloading. Each group must decide what to leave behind.

DISCUSSION QUESTIONS:

- A. What items may not have been available at the times of these explorations?
- B. How long should the passenger list be? Who should go?
- C. List potential problems to be encountered in these expeditions?
- D. What are the responsibilities of the captain, first mate, crew, etc?
- E. Why would a monarch support such an expedition?

Related Activities

1. Assign students to keep a ship's log and/or a diary of experiences encountered on the voyage, (diary would include findings in the "New World", inhabitants, resources, etc.)
2. Ask students to chart their separate courses on a single world map (in different colors).
3. Using present-day maps, compare and contrast population distribution, railroads, highway, cities in areas "explored" by groups.
4. Compare climatic and agricultural statistics for these areas.

Resources

Burns, Shelia, et. al, The Age of Europe; Scholastic Book Services, 1976. Abraham, Henry, and I. Pfeffer, Enjoying World History; Amsco Publishers, 1977.

Credit

A Creative Classroom Activity; "Contract for Journey Exploration" adapted from Edu-Game, Sun Valley, Calif., 1972. Patricia Marshall, compiler and contributor.

Notes To Myself

CONTRACT FOR JOURNEY OF EXPLORATION

THIS CONTRACT IS HEREBY AWARDED TO THE FOLLOWING INDIVIDUALS FOR THE PRUPOSE OF EXPLORATION AND SCIENTIFIC INVESTIGATION. IT IS UNDERSTOOD THAT NO REWARDS OR COMPENSATIONS SHALL BE FORTHCOMING UNLESS PROPER EVIDENCE OF THIS EXPLORATION IS PRESENTED TO THE PROPER GOVERNMENT AGENT. IT IS FURTHER UNDERSTOOD THAT A PUBLIC PRESENTATION SHALL BE GIVEN BY THE RECIPIENTS OF THIS CONTRACT SOON AFTER THE RETURN TO HOME PORT.

1. CREW INFORMATION

LIST BELOW THE NAMES OF EACH MEMBER OF THE CREW, INCLUDING THE NAME OF EACH OFFICER:

CAPTAIN: _____

FIRST MATE: _____

CREW MEMBERS: _____

2. NAME OF THE VESSEL

3. POINT OF DEPARTURE AND AREA OF DESTINATION

FROM _____ To _____

4. SUPPLIES NEEDED:

5. JUSTIFICATION FOR EACH ITEM.

6. OFFICE USE ONLY

CHECK ONE: () APPROVED
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23

Fantasy Island

Curriculum Topic

GEOGRAPHY

Subject

Social Studies

Environmental Topic

ECOSYSTEMS

Grade Level(s)

6 - 7

Site

Classroom

Skills

Mapping, creativity

Author

Robert Slie

Objective

The students will be able to:

1. list geographic land and water forms and position them on a map,
2. construct the model of a simple food web.

To The Teacher

"Landforms are generally grouped into four major types: plains, plateaus, hills and mountains. Within each of these broad categories there are additional surface features of a smaller magnitude. Each of the seven continents has a definite arrangement of landforms that, together with size and shape, distinguishes it as a continental mass. Landforms have a great deal to do with the way in which [living things are distributed.]" Philips, p. 22.

The series of stages through which energy passes in the form of food is referred to as a food chain.

However, few ecosystems have such a simplified food chain. Ecosystems are usually made up of many different producers, consumers and decomposers. Energy passes from one to another in many different food chains. This network of food chains is called a food web. Ecologists find that the more complex the food web is, the more stable (unchanging) the ecosystem is." (from World Book Encyclopedia p. 37)

Before You Begin

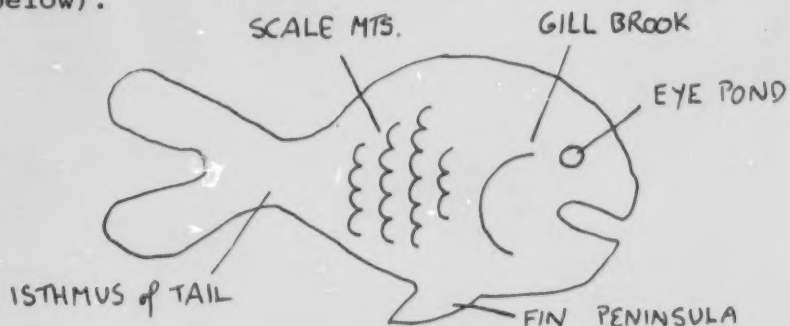
Words To Know

A black and white cartoon illustration of two men fishing in a river. The man on the left is wearing a striped shirt and trousers, holding a fishing rod and a bucket. The man on the right is wearing a plaid shirt and trousers, also holding a fishing rod. A large, stylized fish is jumping out of the water, creating a large splash. In the background, there is a small boat and some trees. The artist's signature 'ZEP' is visible in the bottom right corner.

2000

ACTIVITY

1. Select a chapter for reading from a good geography text, an example of which is by M. V. Phillips, Physical Geography: Interpreting the Physical Features of the Earth; Xerox Publications, Chapter 4.
2. Review the chapter with your students and show illustrations of basic geographical land and water forms (peninsula, strait, plateau, plain, mountains, etc.)
3. Provide the students with background necessary for them to know what the food chain is. (See To The Teacher)
4. Ask students to construct an imaginary island on a picture (a fish, Snoopy, a tree, etc.) outline. The island will include the geographic features listed in the vocabulary section. (See example below).



5. When picture outlines are completed, ask students to develop simple food webs which connect the main parts they have drawn and label. The web should contain at least ten examples of producers, consumers, decomposers.
6. Discussion Questions:
 - a. Why are food web components located in particular geographic areas on your island? How, then, can the geography of a region influence the distribution of living things within it?
 - b. Discuss the food webs constructed by students. Are the webs realistic? Are they complete?

Related Activities

1. Students can construct a model rather than a drawing.
2. Students can prepare oral presentations in which they explain their pictures, or can write creative stories about these pictures.

Resources

Teacher's Guide for Environmental Education Communities, ed. Dr. Irving Leskowitz and Mr. Dale Hartford, available from Center for Environmental Education, National Science Center, 269 Oak Grove St. Manchester, CT 06040

Phillips, M. V., Physical Geography: Interpreting the Physical Features of the Earth, Xerox Publications, 1975.

Endangered Species in Africa

Curriculum Topic

AFRICA

Subject

Social Studies

Environmental Topic

ECOSYSTEMS

Grade Level(s)

7-8

Site

Classroom

Skills

Mapping data, using information for a purpose, identifying consequences of alternatives

Author

Paul Kubicza

Objective

The student will be able to:

1. identify African animals which are endangered
2. describe the reasons for the decline of these animals

To The Teacher

The following disturbing facts reflect the path to extinction on which many African animals are bound. A pair of 70 pound elephant tusks can be sold for \$2,800 in Hong Kong where they are carved into tourist artifacts. This is more money than a Kenyan game warden can earn in 5 years. In order to make the television series "Born Free", lion cubs had to be imported from California to Kenya. Only 60 years ago British settlers in Kenya lived in constant fear of the thousands of lions that roamed Kenya.

Before You Begin

1. Prepare copies of maps of Africa that show the names of all countries.
2. Prepare copies of animal fact sheets on the addax, cheetah, mountain zebra, black rhinoceros, and cheetah.
3. Students need pencils, crayons.

Words To Know

species, range, extinct, endangered, critically endangered, vulnerable, threatened, rare



Conservation News

The International Union for the Conservation of Nature and Natural Resources (IUCN) has defined these terms related to vanishing wildlife:

1. Extinct - A species without any live representatives.
2. Endangered - A species in immediate danger of extinction.
3. Critically endangered - The survival of the species is unlikely without immediate intervention by people.
4. Vulnerable or threatened - The species is abundant in some parts of its range, but is depleted in numbers.
5. Rare - The species is not endangered or vulnerable but is subject to risk because of small population size (eg. the Galapagos tortoise).

These definitions are not universally accepted, and state and federal laws often define these terms differently.

The disappearance of some animal species and the appearance of new ones, is part of the process of evolution. Most of the species that have ever lived on Earth are now extinct. Changes in physical environment (climate, soil, etc.) or biological environment (food sources, disease, competitors, predators) usually cause extinction in nature.

Human activities that constitute major dangers to wildlife include:

1. Hunting for sport.
2. Hunting for profit (ivory, furs, etc.)
3. Destruction of habitat.
4. Use of animals for scientific research.
5. Zoos and pet trade.
6. Introduction of competitors or predators.
7. Killing of animals regarded as pests.
8. Use of herbicides and pesticides.

The Red Data Book of the International Union for Conservation of Nature and Natural Resources listed more than 1,000 species that are in danger of extinction. African species include all species of rhinoceros, the mountain gorilla, the Arabian oryx, the aye-aye (a primate native to Madagascar), the West African ostrich, the African elephant, the addax, the African cheetah, the mountain zebra, and the chimpanzee.

ACTIVITY

1. Introduce definitions of extinct, endangered, critically endangered, threatened or vulnerable, and rare through class lecture or use of a ditto.
2. Pass out copies of African map to all students.
3. Pass out copies of animal fact sheets to all students.
4. Students are to map the distribution of the 5 species on the African maps. They can use a color key and color in the different countries, and a letter key to denote in which countries the animals are located. (e.g. A for addax, C for Cheetah)
5. After completing the mapping, discuss with class the size of the range of each animal. (A species range is the area over which it is normally distributed.)
6. Discuss the reasons for the decline of each animal.

Related Activities

1. Have students find out what other species of African wildlife are endangered.
2. What types of human action can prevent the decline of African animals?
3. Compare the decline of African wildlife with the decline of other species around the world.
4. Present the following question to the class: "Are people bad for their role in the decline of various animals or is it part of people's role on this Earth to be a chief agent of extinction?"

Resources

Uetz, George and Donald Lee Johnson, "Breaking the Web", Environment, December, 1974, pp. 31-40.

"Wildlife in Danger", Newsweek, January 6, 1975, pp. 36-48; Contains excellent pictures of wildlife.

Credit

"Endangered Species - Mammals", Environmental Education Pilot Project, EEC #1433.

GIANT PANDA

DISTRIBUTION: In the middle and late Pleistocene periods, the giant panda was distributed widely over southern China. It now occurs only in northern and central Szechwan, in the mountains fringing the southernmost part of Kansu and in the area of the Chinling mountains just inside the southern border of Shensi province.



STATUS: Rare.

POPULATION: Population size and trend is unknown. The number of individuals in the wild is believed to be in the low hundreds. The number of Giant Pandas in captivity in 1959 was 12 and in 1976 was 12.

HABITAT: It inhabits the Chinacane bamboo and mixed conifer and broad-leaved forests in high mountain ravines, between 2,800 and 4,000 feet high. The climate is very cold and damp. The panda winters in the ravines and moves to the higher mountain slopes in the summer.

REASONS FOR DECLINE:

Because of its restricted range and protected status, there is no reason to believe that it is endangered or that its numbers are declining.

ANIMAL FACT SHEET

CONSERVATION MEASURES

TAKEN: It is strictly protected. The areas in which it occurs have been declared nature reserves, such as the Wangland Nature Reserve (200 sq. km.) in the Minshan mountains, Szechwan. Government education teams have visited villages in the vicinity of the reserves to explain the need for protection of these rare animals.

CHIMPANZEE

HABITAT: It is found in an extremely diversified array of vegetation types; including humid, evergreen, lowland forests; mountain meadows, semi-deciduous forests; and open savannas. The optimum habitat appears to be situated in the transitional zone where the rain-forest belt blends into the Sudanian woodland belt and consists of a mountainous landscape covered by a variegated mosaic of vegetation, including the moist as well as the drier types of forest.



STATUS: It is vulnerable to extinction. A wide-ranging, adaptable primate, it is currently quite depleted throughout its range. Though most populations are seriously depleted and fragmented, none of the three subspecies is within serious danger of extinction.

DISTRIBUTION: It is discontinuous, found in forests and savannas of equatorial Africa; within limits of the Rif Valley to the east; and within the availability of drinking water to the north and south.

CONSERVATION MEASURES

TAKEN: Chimpanzees are fully protected in Uganda, Nigeria, Guinea, Gabon, Sudan, and Zaire.

POPULATION: No estimates of total numbers are available, but the trend is decidedly downward.

ANIMAL FACT SHEET

REASONS FOR DECLINE:

1. Forests being cleared and replanted by more valuable trees results in a loss of food source.
2. The greatest danger is the isolation of small units in marginal areas.
3. It is vulnerable because of the close relationship to man, which gives it unique value for entertainment and scientific research.
4. Its habitat has been depleted through mechanical exploitation.
5. It is hunted for food, for trophies, or sport, and as pets.

MOUNTAIN ZEBRA

DISTRIBUTION:

The Cape mountain zebra occurred only in the mountain ranges of the Cape, chiefly in the southwestern and western areas. The Hartmann zebra inhabited the arid mountains forming the eastern boundary of the sandy coastal strip known as the Namib Desert in South West Africa.



STATUS: Vulnerable.

HABITAT

Preferred habitat is well-watered mountain grasslands and woodland.

POPULATION:

The Cape mountain Zebra has less than 200 animals. The Hartmann zebra was estimated to number 7,000 animals in 1970, against 15,000 in 1960. There are presently four main concentrations in South West Africa with a total of 2,900 zebra. The number of zebras in captivity in 1959 was 148 and in 1976, 148.

REASONS FOR DECLINE:

1. It has been forced from its preferred habitat.
2. Domestic stock offers competition.
3. Pastures have been converted to cultivation.
4. Agricultural areas have been fenced.

ANIMAL FACT SHEET

CONSERVATION MEASURES

TAKEN: Populations of Cape mountain zebra in the Mountain Zebra National Park and the De Hoop Provincial Nature Reserve have been, or are being, built up by the translocation of animals from outside these reserves.

BLACK RHINOCEROS

DISTRIBUTION: Formerly, it was widely distributed in Africa from Cape Province and southwestern Angola to eastern Africa, including Somalia, southwestern Ethiopia, and the southern Sudan. It also occurred in suitable areas between the southern edge of the Sahara Desert and the northern limits of the dense rain forests of Zaire and Nigeria, as far as Lake Chad and Cameroon. It now has a relatively insecure existence, scattered in remnant populations throughout its former range, but surviving mostly in parks and reserves.



STATUS: Vulnerable. It has been seriously depleted except where conserved in national parks and reserves.

HABITAT: Its range extends from arid, thorn scrub country to the high forests of Mt. Kenya and the Aberdare Range at an altitude of 3,500 feet.

CONSERVATION MEASURES

TAKEN: It is legally protected throughout its range and is well represented in national parks and equivalent reserves within its range, but the high value of its horn frequently makes continuing and effective protection nearly impossible.

REASONS FOR DECLINE:

1. The horn has been hunted - illegally.
2. Its habitat has been degraded.
3. Available food supply has been reduced.

ANIMAL FACT SHEET

POPULATION: The total size is unknown. Recent data suggests that populations in Kenya (which may be the largest black rhino population in the world) may be between 6,130 and 9,200. On the other hand, by 1968, fewer than 600 animals remained in Rhodesia, mainly in the Zambesi Valley. In South West Africa there are now fewer than 100 animals, of which 48 are in Etosha National Park. The number of Black Rhinos in captivity in 1959 was 159 and in 1976 it was 159.

ADDAX

DISTRIBUTION:

It occurs in small numbers in Algeria, Niger, Sudan, and in somewhat greater numbers in Chad and Majabatal Koubra.



STATUS: Vulnerable to extinction

HABITAT:

The addax is necessarily dependent on sparse desert forage and consequently is adversely affected when this is destroyed. It is found in the waterless areas of the Sahara, particularly in the dune regions.

CONSERVATION MEASURES

TAKEN: Addax are protected by law in most countries where they occur, but law enforcement in the Sahara scarcely exists.

REASONS FOR DECLINE:

1. The major factor contributing to decline is hunting.
2. The destruction of its food source (desert forage) by the passage of nomadic domestic livestock also contributes.

ANIMAL FACT SHEET

POPULATION:

The number of Addax in captivity in 1959 was 239 and in 1974 was questionable. In Sudan, the last report of Addax that were observed was in 1969, when 15 were seen. In Chad, in 1970, the estimated number of Addax was 1,500. The greatest numbers of Addax reported were in Teh Majabatal Koubra where Monod, in 1960, counted 5,363 tracks in a transverse of 35 km. However, in 1971, Dupuy reported that only scattered remnants remained in this area. The number of Addax in captivity in 1959 was 239 and in 1976 was 240.

AFRICAN CHEETAH

POPULATION: The total number of cheetahs in captivity in 1959 was 643 and in 1976, 763. The remaining populations of the African race possibly total less than 15,000, with a probable range of 8,000-25,000. These figures almost certainly represent half of the cheetah totals in Africa in 1960, and present figures could well be reduced by one half within another 10 years, perhaps by 1980.



STATUS: Vulnerable. The African race has been severely reduced and the Asian race exterminated throughout much of its range, and it is in the endangered category.

DISTRIBUTION: Formerly, it was found in India westward to Egypt, Libya, Morocco, and Rio de Oro; south of the Sahara from Nigeria, Sudan, and Somalia to Southern Africa, but now is in much reduced numbers except in national parks and reserves.

HABITAT: It is found in semi-arid grasslands (but seldom areas of tall grass), scrubland (occasionally quite dense), and various types of savanna woodland; in all cases essentially in association with medium or small-sized herbivores. Exceptionally, it lives in forest margins, but never in the forest itself.

ANIMAL FACT SHEET

REASONS FOR DECLINE:

1. Ranching interests often destroy a cheetah suspected of marauding livestock.
2. Human population has expanded into its habitat. Habitat has also been reduced by agriculture.
3. It has suffered degradation, or loss of habitat, and overhunting, particularly by ranchers.
4. Prey species have been depleted.
5. Spotted furs are in demand.

CONSERVATION MEASURES

TAKEN: In Africa, the cheetah is totally protected in almost every country except in South Africa and South West Africa.

African Savanna

Curriculum Topic

AFRICA

Subject

Social Studies

Environmental Topic

ECOSYSTEM

Grade Level(s)

6-8

Site

classroom

Skills

graphing data
interpreting data
inferring from data

Author

Maryann Cronin Horgan

Objective

The student will be able to:

1. draw and distinguish between a bar graph and a line graph
2. make a climatogram to illustrate the climate of Africa
3. compare the climate of the African savanna to the climate of Connecticut
4. relate climatic conditions to the living things found in that biome.

To The Teacher

A major climate with its individual vegetation and animal life is a large-scaled ecosystem called a biome. Naturally, within the large major biomes will be smaller ecosystems caused by differences in elevation, topography, soils, and man-made modifications, such as farming, grazing and cities.

The world has arbitrarily been divided into major biomes, one of which is the savanna. The main limiting factor in the savanna is precipitation. When the tropical dry seasons are extremely long and severe, the trees must grow far apart because of the competition for water, and between the trees is tall grass. The grasses are able to support large grazing and browsing animals such as rhinoceroses, elephants, antelope and zebra. These first order consumers are then prey for predators such as lions and leopards. The food web is completed by the scavengers and decomposers, ranging in size from the buzzard to the microscopic bacteria and fungi.

Before You Begin

graph paper

rulers

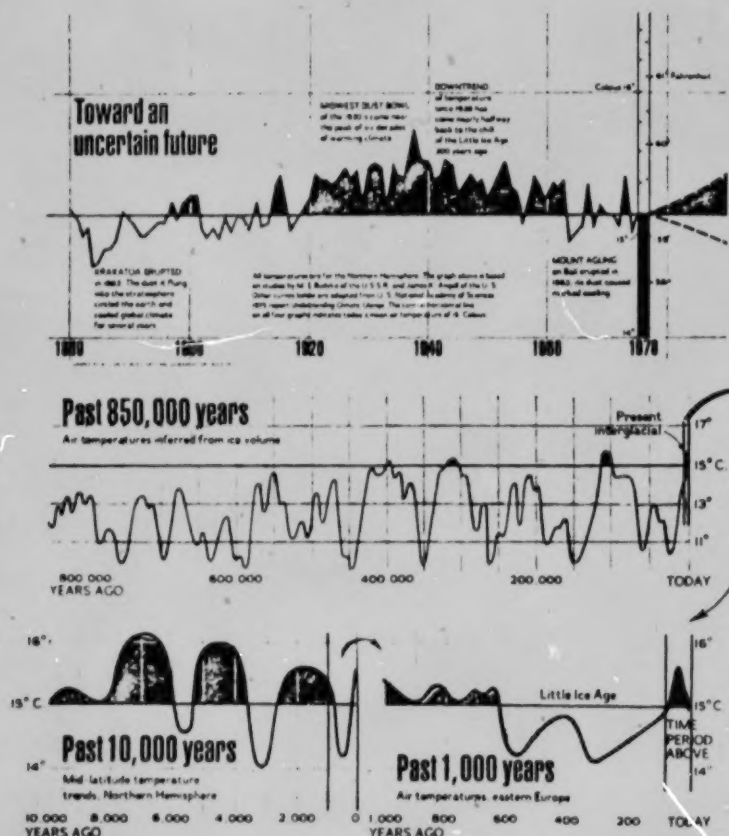
blue and red colored pencils

data on temperature (C°) and precipitation (CM) for a savanna

Words To Know

biome, savanna, precipitation, bar graph, line graph, ecosystem

Global Temperature Trends



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ACTIVITY

1. Students will make a climatogram of the African savanna, using the data provided by teacher. The temperature will be plotted as a line and the precipitation as a bar graph.
2. Students will make a climatogram for New Haven, Connecticut, as above.
3. Students will compare their climatograms and decide how the climate affects the plant and animal life in each, by discussing or writing the following questions:
 - a. What does each climatogram tell us?
 - b. How are the climatograms similiar? Different?
 - c. What is the wettest month in Connecticut?
 - d. Which month has the least rainfall in Connecticut?
 - e. Do we have regular droughts or floods because of these extremes in precipitation?
 - f. What is the rainiest month in the savanna? How much rain falls then?
 - g. How much rain does the savanna receive during its driest month?
 - h. Would you find the temperature more even month after month in Connecticut or in the savanna? Give example.
 - i. What gives us seasons in Connecticut?
 - j. What types of plants grow in Connecticut because of our climate?
 - k. Can man take advantage of this climate? Does he?
 - l. Because of our plant life, what animals do we have in Connecticut?
 - m. Would the temperature be comfortable for you in Africa?
 - n. Are there seasons on the savanna?
 - o. What types of plant life could the savanna support? Why?
 - p. Why are the trees in clusters? Far apart from each other?
 - q. What animals would you expect to find on the savanna?
 - r. Why are the people of the savanna often nomads and hunters?
 - s. What changes might Americans make to the savanna if we owned it?

Related Activities

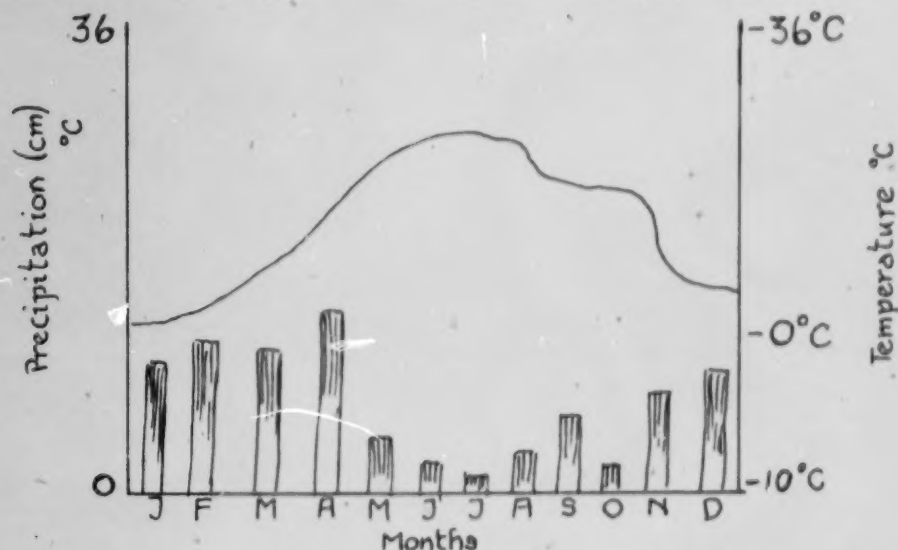
1. Draw a food web for the African savanna.
2. Find out what animals are found on the South American savanna.
3. Find out why governments and groups are trying to protect the savanna lands and animals by laws.

Credit

BSCS Green High School Biology, Rand McNally & Co., Chicago, 1968.

STUDENT PAGE

Given the climatic data on this page construct climatograms on graph paper for Moshi, Tanzania and New Haven, Connecticut. In a climatogram, temperature is plotted using a line graph (color coding is helpful - red is preferable). Monthly precipitation (cm) is plotted on the same graph using the bar graph technique (color code using a blue pencil). A sample climatogram is shown below:



Prepare the climatograms for Moshi, Tanzania and New Haven, Connecticut on separate pieces of graph paper.

CLIMATIC DATA

SAVANNA: MOSHI, TANZANIA

	<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>	<u>M</u>	<u>J</u>
T °C	23.2	23.2	22.2	21.2	19.8	18.4
P (cm)	3.6	6.1	9.2	40.1	30.2	5.1

	<u>J</u>	<u>A</u>	<u>S</u>	<u>O</u>	<u>N</u>	<u>D</u>
T °C	17.9	18.4	19.8	21.4	22.0	22.4
P (cm)	5.1	2.5	2.0	3.0	8.1	6.4

NEW HAVEN, CONNECTICUT, USA

	<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>	<u>M</u>	<u>J</u>
T °C	-1.6°C	-1.6°C	2.8°C	7.8°C	13.6°C	21.6°C
P (cm)	9.9cm	8.4cm	10.5cm	9.9cm	9.8cm	9.7cm

	<u>J</u>	<u>A</u>	<u>S</u>	<u>O</u>	<u>N</u>	<u>D</u>
T °C	21.6°C	20.8°C	17.4°C	11.8°C	6.0°C	0°C
P (cm)	9.3cm	10.4cm	8.8cm	7.6cm	10.0cm	10.0cm

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Plants—Use and Misuse

Curriculum Topic

BIOLOGY
URBAN STUDIES

Subject

Social Studies

Environmental Topic

ECOSYSTEM

Grade Level(s)

6-8

Site

Laboratory

Skills

Collecting, compiling
and interpreting data,
measuring, observing

Author

Pat Perrella

Objective

Students will be able to::

1. measure the amount of water given off in transpiration,
2. describe the effects of salinity on the growth of a plant,
3. identify the benefits of trees to the environment and the ways in which humans interfere with normal tree functioning.

To The Teacher

This activity focuses on the ways in which trees help our environment and the ways in which we, ironically, make it difficult for trees to function and grow. During the discussion students should be able to think of most of the following benefits: trees cool the air by shading and transpiration and absorb noises from the environment; leaf hairs trap and filter out dust and pollen from the air while the trees themselves absorb the waste CO₂; produce O₂ which maintains life, enrich the soil with their decaying leaves, provide food and shelter for wildlife and finally, are beautiful to see.

Human populations in cities make it difficult for trees to function properly by putting pollutants in the air which interfere with transpiration and photosynthesis. Trees can become dehydrated when dirt is packed so tightly around their roots that water cannot percolate into the soil. This happens when we make trails and dirt roads and especially when we use heavy machines to harvest timber. Tall buildings block out sun and cause trees to grow crookedly in their effort to find more light. Roots are damaged when the salt that is used to melt ice is washed into the soil. Finally, dogs excrete wastes on trees which injure the bark and poison the surrounding soil.

Before You Begin

PART I

Materials: for each group: a triple-beam balance, small plastic sandwich bag, pebble, piece of string, graduated cylinder, centigrade thermometer, wet-bulb thermometer, tree identification book

Preparation: 1. Discuss the process of transpiration.
2. Explain how to use a wet-bulb thermometer.

Cautions: 1. This activity requires a warm, sunny day.
2. When your class visits the wooded area have the tree-identification book on hand.

PART II

Materials: for each group: 4 plants same size and type, (You can start radish or bean seeds in the laboratory to be ready for the experiment a week later.), 3 solutions of sodium chloride: 5%, 10%, 15% (w/w of sodium chloride to distilled water), rulers, copies of Student Worksheet and Student Directions.

Preparation: Define the terms "salinity".

Caution: Suggested time for observation is 24, 48, and 72 hours. These can be modified to maximize potential for seeing differences among the plants.



ACTIVITY

Part I: Beneficial Effects of Trees

1. Before going outdoors, ask students to read the directions on their worksheets and to bring materials as indicated on them.
2. Take the class to a wooded area where students divide into groups of 2 or 3.
3. Ask students to select trees with leaves that can be reached easily and which are sufficiently different to allow for comparison. Help students identify their trees.
4. Instruct students to follow directions on their worksheets for Part I "Beneficial Effects of Trees."

Part II: Effect of Increasing Salinity on Plants

1. Keeping the group divisions from Part I, distribute 4 plants to each group.
2. Instruct students to follow directions on their worksheets for Part II.
3. Conduct a discussion in which the class considers the following:
 - a. What are all the ways in which trees benefit our environment? (List on board)
 - b. What are some of the ways that man interferes with the normal growth and functioning of plants in heavily-populated areas like cities?
 - c. What can we do to try to solve some of these interference problems?

Related Activities

Students can design experiments to investigate other environmental factors on plant growth: air pollution, shade from buildings, soil compactness, etc.

Resources

- "Nature's Air Conditioners", Project Learning Tree, American Forest Institute, Education/Research Systems, Inc., 1973, p. 150, EEC #400
- "Green Spaces in City Places, The Environmental Action Coalition, Inc., 1975, p. 1, 2, 9.

STUDENT PAGE

STUDENT DIRECTIONS

Part I: The Beneficial Effects of Trees

1. Before going outdoors, find the mass of your plastic bag. Record this in Table I.
2. Bring the following to the site selected by your teacher: plastic bag, pebble, string, thermometer, wet-bulb thermometer.
3. Select a tree with branches you can reach. Identify the tree. Record.
4. Estimate the number of leaves on a branch and the number of branches on the tree. Record in Table I.
5. Place the pebble in the plastic bag to provide a weight so that water collected in the bag will drip down where you can see it gathered.
6. Choose a leaf on the tree and tie the plastic bag tightly with string around the branch. Leave undisturbed for 24 hours.
7. Record the temperature and humidity of the air indicated when the thermometers are shaded by the tree.
8. Now move into a sunny, unshaded area and, after a few minutes, record the temperature and humidity as indicated here.
9. After 24 hours, collect the plastic bag, being careful not to spill any water. In the laboratory, find the mass and volume of the water collected. Record.

Part II: Effect of Increasing Salinity on Plants

1. Water your 4 plants in the following way: #1 with a 5% salt solution, #2 with a 10% salt solution, #3 with a 15% salt solution, and #4 with plain tap water. Water each plant in the same amount, and make certain that all other conditions are the same: temperature, sunlight, etc.
2. Observe the plants after 24, 48, and 72 hours. Record changes in height and color in Table II. (If the plants need to be watered during the observation period, give each plant the same amount of the same solutions used in step 1.)

Part I: Beneficial Effects of Trees

Table I

Type of Tree	Mass (g) dry bag	Mass (g) bag + H ₂ O	Mass (g) H ₂ O	Volume (ml) from one leaf	Estimate number of leaves on branch	Estimate number of branches on tree	Estimate volume from tree	Shaded temp. humd. °C	Unshaded temp. humd.

1. Show the calculations needed to fill in Column 3.
2. Show the calculations needed to fill in Column 8.
3. What type of tree gave off the most water?
4. What have you learned about some ways trees help the environment?

Part II: Effect of Increasing Salinity on Plants

Table II

Plant	Watering Solution	Height (cm)			Color			Other Observations
		24	48	72 hrs.	24	48	72	
1	5% salt							
2	10% salt							
3	15% salt							
4	tap water							

1. From your observations, state a relationship between increasing salinity and the functioning of plants.
2. How can salt get into the soil and the water that plants absorb?

Plant Dyes

Curriculum Topic

COLONIAL PERIOD

Subject

Social Studies, biology,
arts and craft

Environmental Topic

ECOSYSTEMS

Grade Level(s)

6-8

Skills

Following directions; measuring,
developing self confidence, ex-
perimenting

Site

Classroom - out of doors
area for collecting plant
material

Author

Thomas J. Kotulski

Objective

Students will be able to:

1. use plant materials to create various colored dyes
2. use these dyes to create a painting and/or dye cloth

To The Teacher

The terms "spinster," warp and woof," "shuttle," "dyed-in-the-wool" and "He's true blue" have been woven into our language. Today, as long ago, the steady rhythm of the spinning wheel and the thump of the loom are heard throughout New England. Weavers and spinsters are doing more of their own dyeing. It's not hard - you can find dye collectors in many common plants.

To begin dyeing one needs a safe source of heat, scales, pots, a few mordants (chemicals that make the dye more permanently bond with the cloth fiber) soft water, wool (it absorbs dye easiest of all fibers) and plant material.

Harvest plants just before they bloom, remembering that weather and soil conditions will affect dye color. Be careful not to use beets or other vegetables that produce exotic colors while cooking. These are stains which will quickly fade. When dyeing, collect more plant material than you think you'll need especially if you're dyeing a large amount of cloth. The extra plant material can be dried and used later for dyeing.

Wool can be purchased as fleece or skeins. Be careful with skeins since they are a blend of man-made and natural fibers and the former will not take a dye evenly. Unwashed fleece must be soaked 12 hours in very hot water, then squeezed out gently - never twisting or wringing, finally wash in a weak solution of soap and rinse several times allowing the fleece to dry in a shady place.

Pots should be enamel, stainless steel, or glassable to hold 4-4.5 gallons of water. Avoid aluminum pots because they react chemically with the mordants. Iron pots gray or "sadden" colors.

Your scale should measure fractions of grams up to a kilogram. Use the scale to measure cloth, mordants and plant materials.

Most dyes require a mordant. A list of essential mordants to have on hand includes: aluminum (1) (potassium aluminum sulfate), Cream of tartar (1) (potassium acid tartare), chrome (2) (potassium dichromate) tin (2) (stannous chloride), iron (2) (ferrous sulphate). Aluminum and Cream of tartar bring out soft natural colors, chromes make colors "authoritative," tin brightens them and iron "saddens" them. (1) note: $\frac{1}{4}$ - $\frac{1}{2}$ tsp. per cup (473 mil.) of liquid. (2) $\frac{1}{2}$ ounce per pound of wool.

Dye plants growing in New England will generally yield soft earth tones ranging from yellows through gold, green, reds, tans and browns to grays. Plant material can be broken up into two groups according to how they're harvested. (1) leaves, stems, flowers, barks, nuts, or roots form the fresh group and (2) lichens form the fermented group.

Plant material can be either fresh or dried. You need about 2 liters of stems and leaves or blossoms; 2 kg. of nut shells, 1 kg. of roots for each kg. of wool to be dyed. Dried plants should be broken and pulverized, fresh material should be shredded before trying to extract the colors.

This activity can be utilized to compare colonist's life-styles and dependence on the natural world to our own today.

Before You Begin

Make the use of collecting time to teach conservation practices in collecting. The materials collected should not noticeably change the environment of an area in which they were found. Some plants are protected by law from being picked. Find out which ones are in your area. Investigate the possibility of poisonous plants in your area. Be sure to supervise carefully throughout this activity. Make sure students do not attempt to taste any of the plants or berries they collect.

NATURAL DYEING ** GETTING STARTED

1. Start collecting rainwater in rust-proof containers. Glass jars, enamel pots, plastic trash cans make good containers. Try to collect several gallons.

2. Read about the natural dye process. The two most useful (and inexpensive!) books are from the Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, New York 11225. Ask for #72 Natural Plant Dyeing and #46 Dye Plants and Dyeing. Each sells for \$1.50. A must!

3. Locate and purchase mordants. First try the grocery store, then the drug store. Some will have to be mail-ordered (see accompanying sheet). Don't buy large quantities. Usually a small amount goes a long way. Here's a list of common mordants, their scientific names, approximate cost and amount used per pound of wool. (Different dye books prescribe varying amounts.)

Alum--Aluminum potassium sulfate--\$.30/8 oz.--3 to 4 oz./lb. of wool
Chrome--Potassium dichromate--\$.35/4 oz. -- $\frac{1}{2}$ oz./lb. of wool
Iron/Copperas--Ferrous sulfate--\$.25/8 oz.--3 oz./lb. of wool
Tin--Stannous chloride--\$.45/1 oz.-- 2 tsp/lb. of wool
Copper sulfate--Cuprous sulfate--\$.55/8 oz.--2 oz./lb. of wool
Cream of tartar--Potassium bitartrate--\$.75/8 oz.--4T/lb. of wool

some recipes also call for vinegar, baking soda, and non-sudsing ammonia.

4. Buy some natural, unbleached wool yarn. This should be available at most yarn shops or spin your own!

A LIST OF PLANT MATERIAL AND THE COLOR DYE THEY PRODUCE

Color

yellow-green
blue - violet
purple
reddish purple
reddish pink

violet
blue
dark brown
reddish brown
yellow

rose-tan
green

yellow-orange
salmon
black
rose red

apple bark
cherry root
elderberries, black raspberries
pokewood berries
dandelion roots, cherries,
strawberries, cardinal
flowers, sorrel roots and
bark red oak bark, hemlock
bark

grapes
blueberries (boiled)
walnut husks (boiled)
buckeye husks
goldenrod (boiled) willow
leaves, ash (inner bark)
tulip tree leaves, St. John-
swort flowers, ragweed, bur-
dock, marigold blossoms

birch bark, willow bark
plaintain leaves, and root
(boiled) nettle, lily of the

valley
bloodroot (boiled)
cherry bark
walnut husks, suman leaves
coreopsis

Note: gather bark in the spring when the sap's running.

Mordant cautions:

1. Tin may cause the wool to become brittle.
2. Chrome is light sensitive, so wool dyed with this mordant must be protected from light until the dyeing is finished.
3. It is best to add tin, chrome, iron as desired to aluminum - mordanted wool in the final minutes of the dyeing process.
4. The wool must be lifted out and set aside while additional chemicals are being dissolved in the dye bath.
5. Use wooden spoons, glass rods or smooth sticks to stir the wool.

ACTIVITY

Action: Dyeing with Aluminum As A Mordant

1. Heat 4-4½ liters of water in a large enameled pot.
2. Dissolve 4 ounces of aluminum and one ounce of cream of tartar in a small amount of water. Add to the pot of water.
3. Immerse one pound wetted clean wool into bath and simmer for an hour stirring occasionally.
4. Lift out and press gently to remove water.

Note: if the wool seems sticky you've used too much aluminum. To remove the excess aluminum rinse gently.

5. Chop or crumble plant material into pieces in another pot. Cover with water, and let stand overnight.

6. In the morning boil and simmer plant material for at least ½ hour to release all the plant dye.

7. Add enough water (4 gallons) to cover wool.

Note: Dilution of water will not dilute dye.

8. Heat dye before adding wetted; aluminum mordanted wool. Enter all the wool at once to ensure that the lot will evenly dye.

9. Color of the dye will depend upon how long the wool is left in the dyeing pot.

10. Rinse several times with hot water when desired color is achieved and squeeze dry.

DYES THROUGH FERMENTATION

Color

Plant sources are lichens

Dark red

Umbellicaria pustula

Dark purple-blue

Gyrophora dillenti

Notes:

Dyes made by this process are extremely potent, no mordant is necessary. They don't lose their dyeing strength despite re-use (up to 10 dye lots). They use a cold water dyeing process that occurs overnight. Collect lichens in August and allow them to dry thoroughly. When dried crumple plant material between your hands and put the material into a gallon container. Moisten the lichen by slowly adding a solution of one part ammonia (the non sudsing kind) to 2 parts water. Cap and shake vigorously.

Keep the jar warm 60-75 degrees f for a period of 15-20 days. Shake the jar every 2-3 days when ready to dye enter wool in a cold dye bath and leave overnight. The result is magenta. To get more mileage out of this dye, heat the dye in an enamel pot letting it simmer 5-10 minutes. Enter wetted wool and it will produce brilliant orchid colors.

Discussion questions:

1. Where did colonists obtain their necessities: food, clothing? Where do we go today?
2. What can you generalize about the colonist's dependence upon their society and our dependence on our society? Who is more dependent, more helpless?
3. What did colonists have to do in order to make their own clothing. (make a list)
4. How did they dye their clothes? Bake their bread?

Related Activities

Make a biodegradable soap with which to clean up.

Resources

Natural Dying Bibliography

1. Adrosko, Natural Dyes and Home Dyeing, Dover Publications, Inc., 1971.
2. Bolton, Eileen, Lichens for Vegetable Dyeing, Studio Vista Publishers, London. 1960. Available through Robin and Russ Handweavers, 533 N. Adams St., McMinnville, Oregon 97128.
3. Brooklyn Botanic Gardens, Dye Plants and Dyeing (#46), B.B.G., 1000 Washington Avenue, Brooklyn, N.Y., 11225, \$1.50.
4. Brooklyn Botanic Gardens, Natural Plant Dyeing (#72), B.B.G., 1000 Washington Avenue, Brooklyn, N.Y. 11225, \$1.50.
5. Furry, Margaret S., Viemont, Bess M. Home Dyeing with Natural Dyes, Thresh Publications, 443 Sebastopol Avenue, Santa Rosa, California 95401, \$1.25.
6. Krochmal, Arnold and Connie, The Complete Illustrated Book of Dyes from Natural Sources, Doubleday and Company, Inc., Garden City, N.Y. 1974, \$4.95.
7. Lesch, Alma, Vegetable Dyeing, Watson-Guptill Publications, 1970. \$7.95.
8. "Shuttle, Spindle and Dyepot Magazine", Handweavers Guild of America, 998 Farmington Avenue, West Hartford, Ct., 06107. \$9.00/4 issues/year. Every issue has articles about natural dyeing.
9. Weigle, Palmy, Ancient Dyes for Modern Weavers, Watson-Guptill Publications, 1974, \$8.95.

WHERE TO BUY MORDANTS

1. Earth Guild
Dept. S, 15 Tudor St.
Cambridge, Ma. 02139
2. Fiber to Finish
South Road
New Hartford, Ct. 06057
3. The Mannings
RD 2
East Berlin, Pa. 17316
Phone 717-624-2223
4. Traditional Handcrafts
571 Randolph Street
Northville, Mi. 48167

Plants A La Carte

Curriculum Topic

PRIMITIVE SOCIETIES

Subject

Social Studies

Environmental Topic

ECOSYSTEMS

Grade Level(s)

7 - 8

Site

Wooded

Skills

Identifying plants
Following directions

Author

Robert Slie

Objective

The students will be able to:

1. make inferences about primitive culture,
2. identify and prepare, as a meal, edible plants found in nature.



To The Teacher

Very early, human beings were more immediately and obviously dependent upon the natural environment. There was no need for systems of agriculture, for they lived off the land and ate what they could collect. In the era of Primitive Man, the ability to find edible plants and animals was essential for survival. By contrast, most people today seldom stop to consider their dependency upon the green biosphere, because, among other reasons, processed food is so readily available.

This activity will increase student awareness of edible plants found in nature and increase their understanding of how primitive cultures depended almost solely on the natural environment for food.

This activity will be implemented most effectively when students have read and discussed material about early human culture or finished a unit on a primitive societies still existent in today's world. (See resources).

Before You Begin

Canvas the school campus to insure availability of the common plant species that the students will hope to find. You should know of and notify the school nurse of any students with allergies (e.g., bee stings).

A presentation on poisonous plants might be given before the nature walk. Students should be warned and provisions should be made to wash and clean collected plants to avoid ingestion of pesticides possibly sprayed in the area.

Words To Know

primitive, edible, adapt, environment



ACTIVITY

1. The teacher should arrange for students to take a nature walk on the school campus or nearby field and wooded area.
2. Ask students to collect any edible plants found in the area of their walks. To do this, they should be equipped with a copy of the graphic illustration of edible wild plants included with this activity.
3. Ask students to prepare a meal from the plants collected by using recipes from the illustration sheet.
4. Discussion questions:
 - a. How does this food compare to manufactured food?
 - b. Could a person today, like primitive man, survive by solely depending upon the natural environment?
 - c. What are the advantages and/or disadvantages of "natural food" in comparison with "store bought" food?

Related Activities

1. Class cook book on wild edible foods.
2. Grow an herb garden in class.
3. Make a loom and, as the year progresses, have all class members add natural materials which they find to the weaving.
4. Make natural dyes and dye tee-shirts.
5. Investigate local edible wild animals (e.g., periwinkles, mussels).
6. Make an illustrated book of edible wild plants.
7. An American History class could report on the wild plants used by the Indians as food, clothing, weaving and dyes; or by the early Colonists for medicines, beverages, cloth, tobacco, etc.

Resources

Historical:

- Baldwin, Gordon C., Stone Age People Today, W.W. Norton, 1964
Dickinson, Alice, The First Book of Stone Age Man, Franklin, 1962
Epstein, Sam and Beryl, All About Prehistoric Caveman, Random House, 1959
Marcus, Rebecca, Survivors of the Stone Age, Hastings House, 1975
Stoutenburg, Adrien, People in Twilight: Vanishing and Changing Cultures, Doubleday and Co., 1971

Wildfood:

- Fernald, M.L. and Kinsey, A.C., Edible Wild Plants of Eastern North America
Gibbons, Euell, Stalking the Wild Asparagus, David McKay Co., Inc.
Harris, B.C., Eat the Weeds
Medsger, Oliver, Edible Wild Plants, MacMillan Company

Plant Identification:

Mathews, F.S., Field Book of American Wild Flowers, G.P. Putnam's Sons

McKenny, M. and Peterson, R.T., A Field Guide to Wildflowers, Houghton Mifflin Company

Petrides, G.A., A Field Guide to Trees and Shrubs, Houghton Mifflin Co.

Rickett, H.W., The New Field Book of American Wild Flowers, G.P. Putnam's Sons

Wherry, E.T., Wild Flower Guide, Doubleday and Company

Credit

Maryann Horgan, contributor



STUDENT PAGE

EDIBLE WILD PLANTS

Many of our common wild plants are edible. Nutritionally they are as good as "store bought" food, and flavorwise many are distinctive and pleasing. Here is a selection of plants that can be easily obtained in this region with simple equipment such as knife, spade, pail and plastic bags.

CAUTION — Before eating a wild plant, one should check its identification (see list of references) and be certain that the correct part of the plant is chosen and prepared in a recommended manner.

POT HERBS: The leaves should be washed, placed in pot and covered with boiling water (cold water "fixes" bitterness). Boil for a minute, pour off and add more boiling water. Repeat through three water changes, boiling the last until tender.

- Dandelion (leaves — before plant blooms)
- Chickory (leaves — early spring)
- Lamb's quarters (leaves — plant less than one foot)
- Milkweed (new leaves — June-July)
- Mustard (leaves — early spring)
- Winter Cress (leaves — very early spring)

OTHER GREEN VEGETABLES: Cook (same directions as for pot herbs) and serve buttered:

- Day Lily buds (just before blooming)
- Milkweed buds (tight unopened clumps)
- Milkweed pods (while still firm — about 1")
- Milkweed shoots (up to 6" high)
- Purslane tips (gather all summer)

FRIED FOODS: Dip in egg batter, fry in hot fat:

- Day Lily buds and flowers

STEAMED FOODS: Steam and eat like corn-on-the-cob with butter

- Cattail buds (pick when breaking through papery sheath, before pollen shows)

BOILED FOODS: Boil thirty minutes (add a pinch of baking soda). Drain and cook ten minutes in little water. Season with butter and salt:

- Burdock roots (dig in June and early July — peel)



LAMB'S QUARTERS
(*Chenopodium album*)
common garden weed

BAKED GOODS: Sift and use half and half with flour in muffins or biscuits:

- Cattail pollen (hold heads over pail and rub off yellow pollen — June, July)

SALADS: Wash and use in salads:

- Purslane tips
- Yellow Wood Sorrel leaves
- Young Dandelion leaves
- Sedum (Live Forever)
- Thistle nuts (found inside green flower envelope)
- Crown of Chickory (portion underground above root — early spring)
- Wild Garlic (top leaves chopped)

BEVERAGES:

- Black Birch tea: Pick small twigs; steep in hot water fifteen minutes.

- Sumac lemonade: Crush ripe red berries in water; strain and add sugar if desired.

- Chickory or Dandelion "coffee": Roast roots in slow oven until brittle and brown inside. Grind and brew as coffee, using a little less per cup.

FRUITS: Try Juneberry (Shadbush) fresh, stewed, in pies or sun dried.

CONFECTION: Burdock candy can be made by boiling the peeled flower stalk twenty minutes in water with a pinch of soda added. Drain and boil the pith in syrup (1/2 cup water, juice and grated rind of one lemon and one cup sugar) until it looks clear.



PURSLANE

Making Plain and Fancy Soap

Curriculum Topic

COLONIAL PERIOD:

How colonists relied on their natural environment to supply their basic needs

Environmental Topic

ECOSYSTEMS: All living things have arisen from and are dependent upon the natural system of the Earth

Skills

Following directions,
experimenting

Subject

Social Studies/Science

Grade Level(s)

6-8

Site

Classroom

Author

Thomas J. Kotulski

Objective

Students will be able to:

1. make a biodegradable soap
2. compare modern consumer practices with those of the colonists.

To The Teacher

Approximately 60% of the world's soap supply is consumed in the U.S.A.- perhaps reflecting the American passion for cleanliness or the shrewd ability of the advertising industry.

Many students today take for granted the corner store which supplies them with food, clothing and other necessities. This activity allows students to compare their present lifestyle with that of the colonists- a group of people who were dependent upon their own resources and skills for life's necessities. Students will make soap, duplicating a process used by the colonists.

Before You Begin

The two basic ingredients in soap are:

1. Lye - this can be commercially purchased. CAUTION: Lye is extremely caustic to skin, eyes, membranes, etc. Do not touch! Students should be cautioned to use extreme care when handling this substance.
2. Animal fats - this can be purchased at the grocery store in the form of suet, or saved from home butchering. In place of animal fats, vegetable oils - olive, linseed or coconut - may be substituted.

Materials:	safe heat source	cloth	knife
	measuring cup	salt	
	sieve	thermometer	
	6-1/2 lbs. rendered fat	vinegar	
	or lard	1 can flake lye	
	1/2 cup sugar	2 large kettles	
	water	sliced raw potato	

Containers to mold soap into bars - such as egg cartons, muffin pans, jelly roll pans, etc.

Prepare molds in advance by lining boxes/trays with cloth dampened in cold water. Keep cloth damp until mold is filled.

ACTIVITY

1. Before involving students in the soap production, discuss the following questions:
 - a. Where did the colonists obtain their necessities - clothing, food, soap?
 - b. Do you know how to make your own clothing, food, soap, etc?
 - c. What ingredients go into soap? How is it manufactured?
 - d. How did the colonists' consumer practices differ from ours today?
 - e. Can you foresee any difficulties the American people might encounter due to their great dependency on society for living necessities?
2. To obtain "rendered fat" cut pieces of fat into stew-sized pieces (4 cm cubes) and heat with small amounts of salt and water in a pot over high heat. (This will prevent the fat from burning and rid the fat of impurities). To render properly, the fat must be heated for 3-4 hours (This step may be done before the class begins).
3. When the fat rises to the surface of the pot, lower the heat to simmer and stir occasionally.
4. Since not all the fat will melt, strain out the impurities through a narrow mesh sieve. The remaining fat is called rendered fat or lard or tallow (This initial process can be avoided by purchasing lard from your meat or grocery store).
5. Clarify the rendered fat by heating again. To time this process, add 2-3 slices of raw potato and watch for browning. When potato is brown, remove from the fat which is then strained and cooled.
6. CAUTION: This step involves lye! Empty a can of lye into 5 cups of hot (not boiling) water into which 1/2 cup sugar has been dissolved. (The sugar makes the soap lather). The lye will heat up on contact with the hot water and produce noxious fumes - be sure this activity is performed in a well-ventilated room. Drinking a weak mixture of vinegar and water will counteract any coughing produced by inhaling the fumes. This same mixture will prevent burning if the lye is spattered on the skin.
7. When the temperature of the lye and the tallow is approximately 90°-96° F, pour the fat slowly - in a thin stream - into the lye.
8. Stir this mixture constantly until it reaches the consistency of honey.
9. Pour the liquid soap into the prepared molds (see Before You Begin).
10. When the soap has hardened slightly, score it with a knife to facilitate later removal.

Related Activities

A Recipe for Luxury Soap:

Ingredients:

- | | |
|----------------------------|-----------------------|
| 1 cup pure olive oil | 3 tbs. of scented oil |
| 1 lb. of canned shortening | |
| 1 cup peanut oil | |
| 1/2 cup plus 2 tbs. lye | |
| 1-1/3 cups of water | |

ACTIVITY

1. Combine lye and water and heat in 1 kettle (Be sure to observe cautions listed in original activity).
2. Melt shortening in another kettle.
3. Pour in the olive oil, then the peanut oil into the shortening.
4. Now add scent and stir.
5. When both lye and oils reach 90°F combine them, stir until thick then pour into soap molds.
6. Molds can be made from: egg cartons, cookie trays.

Be sure to rub mineral oil on these molds so the soap comes out of the mold.

Other things to do:

1. You can carve designs on your soap bars.
2. Add color by using commercial food dyes.
3. Perfumes can be used for scenting your soaps.
4. Package and sell your own soap in school to experience the free enterprise market.
5. Compare the homemade soap comparing process to commercially made soaps.

Resources

The Forgotten Arts: Making Soap at Home, Yankee #6 by R.M. Bacon.

Ecology Puzzle Undoing

Curriculum Topic

ECOLOGY - Interrelationships

Subject

Science

Environmental Topic

ECOSYSTEM

Grade Level(s)

3-8

Site

Natural outdoor area

Skills

Observing

Author

Ed Lisk

Objective

The student will be able to:

1. recognize that interconnections exist in the natural environment,
2. identify the interrelationships that exist among the items he collects and observes.

To The Teacher

One of the most important principles of ecology is that all living things are connected. Every living thing must find resources with which to grow, maintain and reproduce itself. Each living thing provides and receives resources.

Plants provide oxygen in the process of photosynthesis, during which they receive light energy which is then stored in the cells and eventually provides food for animals. In the competition for light to carry out this process, large plants may shade small ones. A further function of plants is their protection of the soil from erosion.

Animals provide plants with carbon dioxide from their breathing and fertilizer from their wastes. Some animals receive food by eating the plants themselves, others receive it indirectly by consuming plant-eating organisms. Herbivores (plant-eaters) may help control plant populations, as predator controls prey. If there are too many predators, however, the decline in numbers of their prey brought about by their own increase will cause a food shortage among them. Other animal populations are controlled in the competition for limited food or living space.

Decomposers (bacteria and fungi such as mushrooms) use dead plants, animals and animal waste as energy sources. In doing so, they recycle nature's left-overs. Many small animals in the soil do the same. This process returns nutrients - nitrogen in particular - to a suitable form for plant use.

First steps towards an understanding of interrelationships in the natural world are to find and observe them, and eventually to identify their elements and functions.

Before You Begin

Materials: small plastic bag or container for each student, 1 large plastic or paper bag, tags for making non-collectable objects, 2 or 3 baby-food jars, pencils and Student Worksheets (as provided here)

Preparation: Find a natural site with a diversity of habitats. Try the survey beforehand yourself.

Words To Know

Producer, decay, herbivore, dependent, consumer



ACTIVITY

Purpose: to find the parts of nature's living puzzle, using clues and questions on the Student Worksheet provided here.

1. Give each student worksheet, pencil and collecting-bag, making students aware of the distinctions between "Bring Back" and "Write About" sections on the worksheet.
2. Direct the students to take small specimens which they will eventually show to their classmates. Advise them not to disturb nature's system by taking unnecessarily large samples.
3. When the treasure hunt has ended:
 - a. Ask individual students to share their results.
 - b. Discuss how the specimens reveal the interconnectiveness of nature.
 - c. Assign each student to write an essay on his/her favorite find. The focus of this essay should be how it is connected to at least one other living thing.

Related Activities

1. Construct a water or land terrarium.
2. Visit other ecological systems: pond, field, forest.

Resources

Project I-C-E; Green Bay, Wisconsin, EEC #607.2

Betros, Harry, Understanding Schoolyard Ecology, Exposition Press, 1972, EEC # A23.

McCombs, L.W. and R. Nicholas, What's Ecology?, Addison-Wesley, 1973, EEC # 394.

Credit

Drawing: Cecelia Zych

Notes To Myself

STUDENT PAGE

Treasure Hunt Clues

Find as many of these as you can in the time you have to work. Think carefully about each clue. Find the parts of nature's puzzle. What makes nature operate? Check off the clue when you find an answer. Use only one clue for each thing.

Bring Backs

- _____ A small thing waiting to grow into something bigger.
- _____ An animal which recycles nature's waste.
- _____ The smallest bit of life that makes food from sunlight energy.
- _____ A small animal with 4 wings.
- _____ A plant (part) which hitches a ride.
- _____ An animal eaten (when it is caught) by another animal.
- _____ Two plants which live together.
- _____ A color which captures sun energy.
- _____ A hiding place for a small animal.
- _____ An animal which lives in dark places.
- _____ A plant which does not make its own food.
- _____ Some animal with 6 legs.
- _____ A twig with opposite branches.
- _____ An animal which eats plants.
- _____ An animal which crawls but will change to one that flies.
- _____ A small plant that floats on the water in a puddle or small pond.

Write Abouts

- The home of a large animal _____
- A flying animal that sings _____
- A place where animals raise their babies _____
- A sign left by a large animal which tells who he is _____
- The biggest living thing in your study area _____
- The protective coating of a large plant _____
- (tell its color and how it looks) 63

A liquid which is important for life _____

The thing which gives energy to all the life in your area _____

A group of living things which are all very much alike _____

Two things which are very much alike and why _____

Why _____



Tree Treasure Hunt

Curriculum Topic

BIOLOGY - PLANTS

Subject

Science

Environmental Topic

ECOSYSTEMS

Grade Level(s)

4 - 8

Site

Wooded area

Skills

Collecting data
Classifying

Author

Ed Lisk

Objective

The student will be able to identify and classify some of the trees observed during the exercise.

To The Teacher

"The woods are lovely, dark and deep," wrote poet Robert Frost, and unknowingly, he pronounced one of the keys to forest ecology. For the organization and history of forest communities is intimately bound up with the availability of light.

The forest is structured in successive horizontal layers. At the top is the canopy, the layer formed by the leaves and/or needles of the tallest trees. Beneath this is the understory, a region of smaller trees and saplings of canopy species. The third stratum is composed of woody bushes, below which is an herb layer of non-woody plants, including both flowering plants and ferns and mosses. Finally, at the bottom of the forest is the soil, with its own plant and animal life. This structure is primarily determined by light - the understory and herb layer species are generally those which are tolerant to shading. They will often leaf out early to use the light available when the canopy trees (in deciduous forests) are still bare. Many of these small plants which are wind-pollinated, flower even before leafing, which avoids the restricted air flow in the woods once a full canopy of leaves is present.

The trees in the understory are maids-in-waiting. If lightning, old age, disease, or a buzz saw fells a tree in the canopy, these understory trees, nourished by the sudden appearance of light reach skyward. The rapid growth literally is a race for the top, for whichever tree or trees fill the gap in the canopy will reach full maturity; those in the shade below will never get the chance. The cumulative effect of these changes in the canopy over time is called succession. Tree species which can survive under low light intensity replace species which grow very well when there is plenty of light but poorly in the shade. In the understory, the former species out-compete the latter and so are ready to take over when gaps occur in the canopy. In northeastern United States, a typical succession pattern is from bare field (typified by crabgrass, horseweed) to grassland (aster) to grass-shrub (broomsedge) to coniferous forest (pine with hardwood understory) to hardwood forest (oak and hickory) over a period of about one hundred fifty years.

The oak-hickory forest is commonly referred to as a "climax" because if left undisturbed (by fire, hurrican, man, etc.) it is much more stable and slower to change than other communities. But even the climax forest is not static nor homogenous. The forest is patchy and composed of a diversity of plant species. This diversity creates a wide variety of micro-habitats for animals and encourages the stability that is characteristic of forest ecosystems. This activity should make students aware that although we speak of forest communities characterized by one or two dominant species, the forest is in fact a complex assembly of many different plant and animal species.

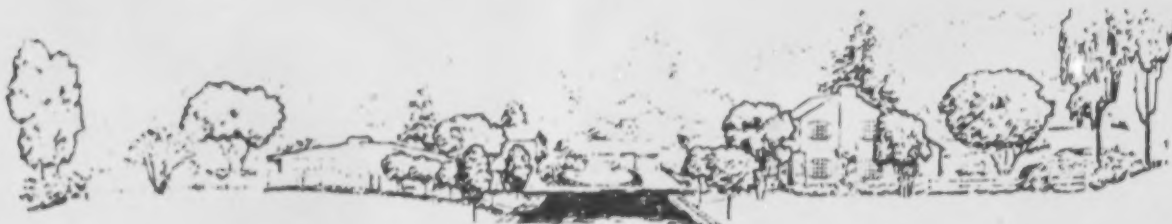
Use the treasure hunt in this activity as practice or an introduction to collecting and identifying shrub and tree types. In order to use classification techniques it is valuable for students to sharpen observational powers, collecting skills, organizational and field techniques, and ability to describe and differentiate among natural objects.

Before You Begin

1. Duplicate worksheets.
2. Select an appropriate wooded site.
3. Assemble collecting bags for each student or group of students and labels for marking collected items.

Words To Know

alternate, opposite, diversity, shrub, tree, lobes, compound leaf, pith, wintergreen, pitch, cone, walls



ACTIVITY

1. Choose an appropriate wooded site.
2. Assemble class outside.
3. Distribute worksheets.
4. Explain that the task is to find as many natural objects as possible that fit the clues on the worksheet.
5. Advise students that samples should be only large enough to show characteristic. Samples from the ground are much better than from a live tree. Be careful of poisonous plants (e.g., poison ivy).
6. "Write abouts" are to be described or located rather than sampled.

Related Activities

1. Have students become familiar with dichotomous identification key for trees and shrubs and identify local trees and shrubs.
2. Have student relate amount of sun and soil types to where they found specific plants.
3. Explore the commercial aspects of trees and wood.

Resources

Braun, E. Lucy, Deciduous Forests of Eastern North America, Blakiston Co., 1950.

Brockman, Frank C., A Guide to Field Identification Trees of North America, Golden Press, 1968 EEC #C106.

McCue, G., The Forests and Man, Benziger, Inc., 1971, EEC #B146.

Watts, May Theilgaard, Master Tree Finder, Nature Study Guild, 1963.

Credit

Ecology Treasure Hunt, Project I-C-E, Green Bay Wisconsin, EEC #607.1, 607.2.

Steve Gold, contributor

Notes To Myself

STUDENT PAGE

DIRECTIONS: IN A WOODY AREA, FIND AS MANY ITEMS THAT MATCH THE FOLLOWING CLUES.. BE SURE TO LABEL ALL SPECIMENS FOUND BEFORE PLACING THEM IN YOUR COLLECTING BAG SO LATER THEY WILL BE EASIER TO IDENTIFY. YOU MAY NOT BE ABLE TO FIND OBJECTS TO MATCH EVERY CLUE.

CLUES

BRING BACKS:

1. _____ A TWIG WITH OPPOSITE BRANCHES.
2. _____ A TWIG WITH ALTERNATE BRANCHES.
3. _____ A LEAF WITH MANY SMALL SAW TEETH.
4. _____ A LEAF WITHOUT ANY TEETH.
5. _____ A LEAF THAT IS VERY LONG AND NARROW BUT FLAT.
6. _____ A LEAF THAT IS ALMOST ROUND.
7. _____ A LEAF WHICH HAS SHARP LOBES.
8. _____ A LEAF WHICH HAS ROUNDED LOBES.
9. _____ A LONG NEEDLE LEAF THAT GROWS IN A BUNDLE OF FIVE.
10. _____ A LONG NEEDLE LEAF THAT GROWS IN A BUNDLE OF TWO.
11. _____ A SHORT NEEDLE LEAF THAT GROWS IN A BUNDLE OF TWO.
12. _____ A NEEDLE CLUSTER OF 12-25 ALL GROWING FROM ONE BUNDLE OR BASE.
13. _____ A NEEDLE THAT GROWS WITHOUT BUNDLES AND IS FLAT.
14. _____ A NEEDLE THAT GROWS WITHOUT BUNDLES AND ROLLS IN YOUR HAND.
15. _____ A TWIG OF TINY OVERLAPPING SCALE-LIKE LEAVES.
16. _____ A FLAT LEAF THAT IS LARGE AND HEART-SHAPED.
17. _____ A LEAF THAT IS A COLLECTION OF MANY SMALL LEAFLETS (COMPOUND LEAF).
18. _____ A LEAF STEM WHICH IS FLAT.
19. _____ A TWIG WHICH HAS PARTITIONS IN THE PITH WHEN CUT WITH A KNIFE.
20. _____ A TWIG WHICH TASTES LIKE WINTERGREEN.
21. _____ A CLUSTER OF RED FUZZY FRUIT FROM THE TOP OF A SHRUB WITH FURRY TWIGS.
22. _____ A TWIG WITH SMALL THORNS.
23. _____ A TWIG WITH VERY LONG SHARP THORNS.
24. _____ A BIT OF WHITE PAPERY BARK (DO NOT CUT THE BARK TO GET IT).
25. _____ A BIT OF GREY-YELLOW PAPERY BARK (DO NOT CUT THE BARK TO GET IT).
26. _____ AN ACORN OR ACORN FRAGMENT.
27. _____ A TREE SEED WITH A WING THAT IS LONG.

STUDENT PAGE, CONT'D.

28. _____ A TREE SEED WITH A FLAT WING AROUND THE SEED.
29. _____ A TREE SEED LIKE COTTON DOWN OR DANDELION.
30. _____ A LONG FLEXIBLE CONE.
31. _____ A STUBBY, TOUGH CONE.
32. _____ A SMALL, SOFT CONE.
33. _____ A CONE-LIKE FRUIT ON A BROADLEAF SHRUB.
34. _____ A LONG HANGING "FLOWER" FROM A SHRUB OR TREE.
35. _____ A LEAF WITH VEINS ALL COMING FROM A LONG MID VEIN.
36. _____ A LEAF WITH VEINS COMING OUT MAINLY FROM THE BASE.
37. _____ A LEAF WITH A FEW LARGE TEETH BUT NOT LOBED.
38. _____ A LEAF WITH TEETH WHICH ALSO HAVE TEETH.
39. _____ A TWIG WITH CORKY WINGS.
40. _____ A TWIG WITH THIN WOODY WALLS AND MUCH PITCH INSIDE.
41. _____ A LEAF WITH LOBES WHICH ARE VERY DEEP.
42. _____ A LEAF WITH LOBES WHICH ARE VERY SHALLOW.

DIRECTIONS: IN THE NEXT SECTION, DESCRIBE THE LOCATION OR EXPLAIN THE OBJECT WHICH MATCHES THE CLUE. DO NOT BRING A SAMPLE OF THE OBJECT TO CLASS.

WRITE-ABOUTS:

1. A SMOOTH GREY BARK _____
2. A SMOOTH BARK WITH STICKY PITCH BLISTERS _____
3. A SMOOTH YELLOW TO WHITISH BARK _____
4. A FAIRLY SMOOTH, SHINY BLACK BARK _____
5. A THICK RIDGED BARK _____
6. A GREY THINNER BARK OF FLAT, SQUARISH OR OBLONG PLATES _____
7. A BARK WITH LONG SHAGGY GREY PARTS BEGINNING TO FALL OFF _____
8. A TREE WITH VERY FRAGRANT FLOWERS _____
9. A TREE WITH A RICH PINEY SMELL _____

STUDENT PAGE, CONT'D.

10. A TREE THAT GROWS DOWN IN WET, SWAMPY GROUND _____

11. A TREE WITH BARK THAT IS IN LAYERS OF BROWN AND WHITE OR BLACK AND WHITE _____

12. A TREE WHICH HAS SMALL CHERRY-LIKE FRUITS WITH STONY PITS _____

GOOD LUCK!



Instructions for Making a Model of Spaceship Earth

Curriculum Topic

ECOLOGY: Earth can be thought of as a spaceship containing all the air, water, and land we will ever have.

Environmental Topic

ECOSYSTEMS

Skills

Problem solving

Subject

Science

Grade Level(s)

6 - 8

Site

Classroom or outdoor area

Author

Thomas Kotulski

Objective

Student will be able to:

1. infer that Earth resources are finite

To The Teacher

"All of the various ecosystems on earth are connected to one another. Thus, if we group together all of the various ecosystems on the planet, we have the largest life unit, or planetary ecosystem, the ecosphere. The ecosphere can then be visualized as a vast graduation of diverse ecosystems all interconnected in a complex fabric of life. These connections help preserve the overall stability of an ecosystem. But disrupting or stressing an ecosystem in one place can have some complex, often unpredictable, and sometimes undesirable effect elsewhere. This ecological backlash effect has been eloquently stated by the English poet Francis Thompson: "Thou canst not stir a flower without troubling a star." The goal of ecology is to find out just how everything in the ecosphere is connected."

In the classroom, students can create miniecosystems as models of the ecosphere. There they can experiment with changes that alter this delicate system. One convenient "classroom ecosystem" is the terrarium.

Terrariums date back to at least 1829, when Dr. Nathaniel Ward, a London surgeon, placed the chrysalis of a sphinx moth in a closed glass container with earth and vegetation. In time, he became interested in the grasses and ferns which sprouted and continued to grow in the sealed jar.

Today, terrariums can be made from aquaria, brandy snifters, glass canisters, candy jars, canning jars. Small-necked jars are more attractive, though difficult to use. These are referred to as Bottle gardens. For classroom use the large, economy-sized pickle and mayonnaise jars are the best. Ask your school cafeteria, or local restaurant to save them for you.

FLOWERING PLANTS FOR TERRARIUMS

Begonia - wax and dwarf varieties are best
Crossandra - pastel, orange flowers
Cuphea (cigar plant)-shrub-like
Episcia - orange, pink, white flowers
Exacum
Jasminum - slow growing, fragrant yellow/white flowers
Orchid - use miniatures
Oxalis - clover like leaves, multicolored flowers
Punia (dwarf pomegranate) - blooms, bear reddish fruit
Saintpaulia (African violet) - use dwarf varieties

WOODLAND PLANTS FOR TERRARIUMS

Pipsissewa - plain or striped-leaf, low-growing
Gold thread - dainty, clover-like plant
Trailing Arbutus - needs acidic soil
Ferns: spleenwort - all interesting
 maiden hair - all interesting
 walking fern - all interesting
Fungi/lichens - good accents, but easy to mold
Rattle snake plantain - woodland orchid, white-veined leaves
Club moss - good ground cover
Partridge berry - small round leaves, red berry
Shinleaf - puts out spikes of waxy bell flowers
Rainbow fern - iridescent "fern," tiny blue-green leaves

Related Activities

Make varieties of bottle gardens which will be representative of various ecological communities, e.g., forest, meadow, swamp.

TROPICAL FOLIAGE PLANTS FOR TERRARIUMS

Acorus (Japanese sweet flag) - grass-like, variegated, dwarf variety available
Adiantum (maiden hair fern) - delicate leaflets on dark stem
Aglaonema (Chinese evergreen) - variegated leaves, grows up to 3'
Aucuba (gold-dust tree) - leaves speckled with yellow
Buxus (boxwood) - slow growing shrub, shiny-dark leaves
Calathea (peacock, plant) - red stalk, leaf undersides red, maximum height 8'
Callisia (striped inch plant) - fast-grower, but colorful, red leaf underside
Chamaedora (parlor palm) - miniature, slow growing
Codiaeum (crotons) - coarse texture
Cymbalaria (kenilworth ivy) - dainty-leafed creeper (ground cover)
Ficus repens - ground cover
Fittonia (mosaic plant) - prominently veined leaves
Hedera helix (English ivy) - many varieties
Helxina soleioli (baby tears) - tiny, dense leaves, prolific growth
Maranta (prayer plant) - leaves respond to light
Tradescantia (wandering jew) - easily grown
Zebrina pendula (zebra-plant) - easily grown

CARNIVOROUS PLANTS FOR TERRARIUMS

Darlingtonia (cobra-plant)
Dionaea (venus fly-trap) - hinged leaves open and close to capture insects
Drosera (sundew) - secretes sticky liquid on palm shaped leaves
Pinguicula (butterwort) - curled leaves trap insects
Sarracenia (pitcher plant) - leaves form tube

Before You Begin

For each student (or group of students):

One large jar or container
enough gravel to cover bottom to a depth of $\frac{1}{2}$ "
enough charcoal to cover bottom to a depth of $\frac{1}{2}$ "
enough soil to a depth of 2" (be sure to sterilize soil if collected from the school site)
cap or cork to cover jar
sealing wax
planting tools, plants

For the entire class:

watering can, mist sprayer
newspaper
dust pans, and brooms

Words To Know

plant, bottle garden, system, ecology, energy, pollution, soil, gravel, charcoal, spaceship

ACTIVITY

Depending upon the age and ability of your students, either lead them or allow them to work independently with the following directions:

1. Wash and dry a jar thoroughly.
2. Unless your jar opening is wide enough to allow you to reach in with your hands, fashion a long funnel of newspaper, or better, lightweight card board.
3. Pour in enough gravel to cover the bottom of the jar to a depth of $\frac{1}{2}$ ". This will serve as drainage.
4. Now funnel charcoal, powdered or chipped, over the gravel to a depth of $\frac{1}{2}$ ". This will serve to purify the water and soil. DO NOT USE charcoal briquets - they contain a petroleum derivative poisonous to plants.
5. Add soil indigenous to plants to be used. To avoid mold, sterilize the soil in a 300 degree oven for 2 hours. Make sure the soil is moist enough to be crumbly but not sticky. Add soil to a depth of 2" in the jar.
6. Landscaping can be accomplished by pushing soil into hills and valleys. If the soil is raised in the back of the terrarium, it affords an effect of visual continuity.
7. Choose plants compatible with each other and soil type. Do not crowd plants. Think of the terrarium as a natural scene. Tall plants should be placed in the back. Prune plants before planting. Think before you act.
8. Now you are ready to plant. Make tools by attaching spoons to a dowel or thin stick, or use a spool to tamp down soil. Use a coat hanger bent into a small end loop for lowering plants into bottle garden. Attach paper towels to coat hangers for final cleaning of inner glass walls. Tweezers can be made by binding together a split length of bamboo. Now plant.
9. Complete your landscape by adding moss for ground cover, pieces of driftwood, colored pebbles and sand to simulate streams or paths.
10. Water sparingly with a mist sprayer. Do not overwater. Pour water down the outer sides of the bottles to clean them. Soft artists brushes can be used to dust off soil from plants.

CAUTIONS

1. Do not worry about condensation.
2. Sterilize soil.
3. Too much light will burn plants - avoid direct sunlight.
4. Provide students with enough clean-up tools and ample time to clean up.

Credit

Quotation from:

Miller, G. Tyler, Jr., Living in the Environment: Concepts, Problems and Alternatives; Wadsworth Publishing Co., Inc., Belmont, Ca, 1975., p. 49-50.

Predator-Prey Game

Curriculum Topic

ECOLOGY -
Ecological relationships in a
community

Subject

Science

Environmental Topic

ECOSYSTEMS-
An ecosystem consists of all
the plants and animals inter-
acting with each other and
their non-living environment.

Grade Level(s)

6 - 9

Site

schoolground

Skills

Making and reading a table
Interpreting data

Author

Maryann Cronin Horgan

Objective

After playing the game Predator-Prey, students will be able to:

1. gather data about the predator-prey relationship
2. organize data in table form
3. generalize from data and discussion about the many facets of the predator-prey relationship.

To The Teacher

The law of nature is eat or be eaten. The eater is the predator; the eaten, the prey. Predators (including herbivores) possess certain characteristics which enable them to capture and eat prey; in turn, prey (including plants) have evolved behavior enabling them to hide or escape from their predators. Predator and prey populations, unless disturbed, are kept in dynamic equilibrium by nature. Predators which prey on only one or two species may risk extinction if a disturbance causes their prey population to collapse. Predator populations that become too large or too efficient may also become extinct if prey become scarce. And, any prey population which cannot hide or escape predation using camouflage or mimicry will soon be destroyed. Ideally, predator and prey population; should fluctuate cyclically - rising prey population causing an increase in predator numbers which reduces the prey population: the scarcity of prey causes a decline in the predator population leading to an increase in prey numbers.

Before You Begin

It would be helpful to preface this activity with an activity illustrating the concept of variation within a single population. Variation is the basis of Darwin's theory of natural selection. For example, within a prey population, the unfit individuals are eaten and therefore cannot pass on their "unfit" genes. The surviving prey pass on the "fit" genes to future generations and the species slowly changes. Of course, the same sort of selection is occurring in the predator species: the unfit predators who cannot catch sufficient prey fail to pass along their genes. Thus, predator and prey engage in a sort of coevolutionary race - the prey evolve escape and defense mechanisms while the predators evolve ways to circumvent these defenses.

With an older group of students, variation could be easily demonstrated by having the students measure ear length, foot length, etc. Display results in table or graph form. The results are always predictable: a few large, a few small, and the majority in the middle. These results could be discussed before playing the Predator-Prey game.

Caution:

If this activity must be done inside, scatter the prey on desks, floor, etc. Use prey made of colored pieces of construction paper (1"sq.) Try to camouflage pieces to match environment.

Materials:

Three blindfolds (scarves) for the blind predators, meter sticks or string to mark boundaries outside of prey enclosure (size is optional - e.g., 16m²), colored wooden toothpicks to be used as prey (total of 25 or less depending on size of prey enclosure)

Note: Choose toothpicks in colors which camouflage toothpicks with the environment. Color touch-ups can be made with magic markers.

You will also need a data table on which to collect data. This may be placed on the blackboard, on a transparency or ditto master.

	PREY							
PREDATORS	red	yellow	green	blue	brown	tan	mottled	TOTAL
blind								
finger								
free								

Words To Know

predator, prey, adaptation, competition, survival, interrelationship, variance, natural selection, "fit", "unfit"



Mallard duck's foot. It is webbed for swimming. This type of foot also serves quite well for walking.



The mallard's beak is designed for feeding on land as well as in the water.



Typical predator's foot. It is better fitted for grasping than walking. The talons tighten when grasping prey.



The beak of the predator is designed for tearing its prey apart.

Credit: Harrington, R. and R. Passmore, Learning About Environment, Canadian Wildlife Federation, 1972, p. 25

ACTIVITY

1. Nine students are chosen by the teacher to be predators. Each of the predators has special adaptations:

a) Three students will be blindfolded; they are the blind predators.

b) Three students must walk without bending their knees and may only pick up prey with their middle and index fingers. They are finger predators.

c) Three students will be free predators. That is, they may use any means possible to catch their prey.

2. The predators are led to the perimeter of the marked area. On a signal from the teacher, the predators have 30 seconds to capture their prey (toothpicks).

3. Predators tally their catch and place results on chart for class to analyze. In discussion, consider the following questions:

a) Which predators were most successful? Why?

b) Which prey were best adapted to their environment?

c) Which prey survived most successfully?

d) Which prey were camouflaged?

e) How might the prey population change through time?

f) How will competition affect the predator population?

g) Are any of these populations in danger of extinction?

Related Activities

1. Play the Predator-Prey game again and have some new rules set by the students.

2. The game could be played again using only camouflaged toothpicks (prey) to show results of what happens as populations evolve.

3. Draw a food web incorporating as many predator-prey relationships as possible.

4. Research some predator control programs in the U.S. For example, Kaibab Plateau created a deer reserve and killed off bobcats; and bounties have been offered for coyotes and hawks in order to protect the livelihood of chicken and sheep farmers. List ecological harms.

5. Research how man can change the environment and therefore disturb the predator-prey relationship. For example, when vegetation is destroyed, prey is unable to hide from predator.

Resources

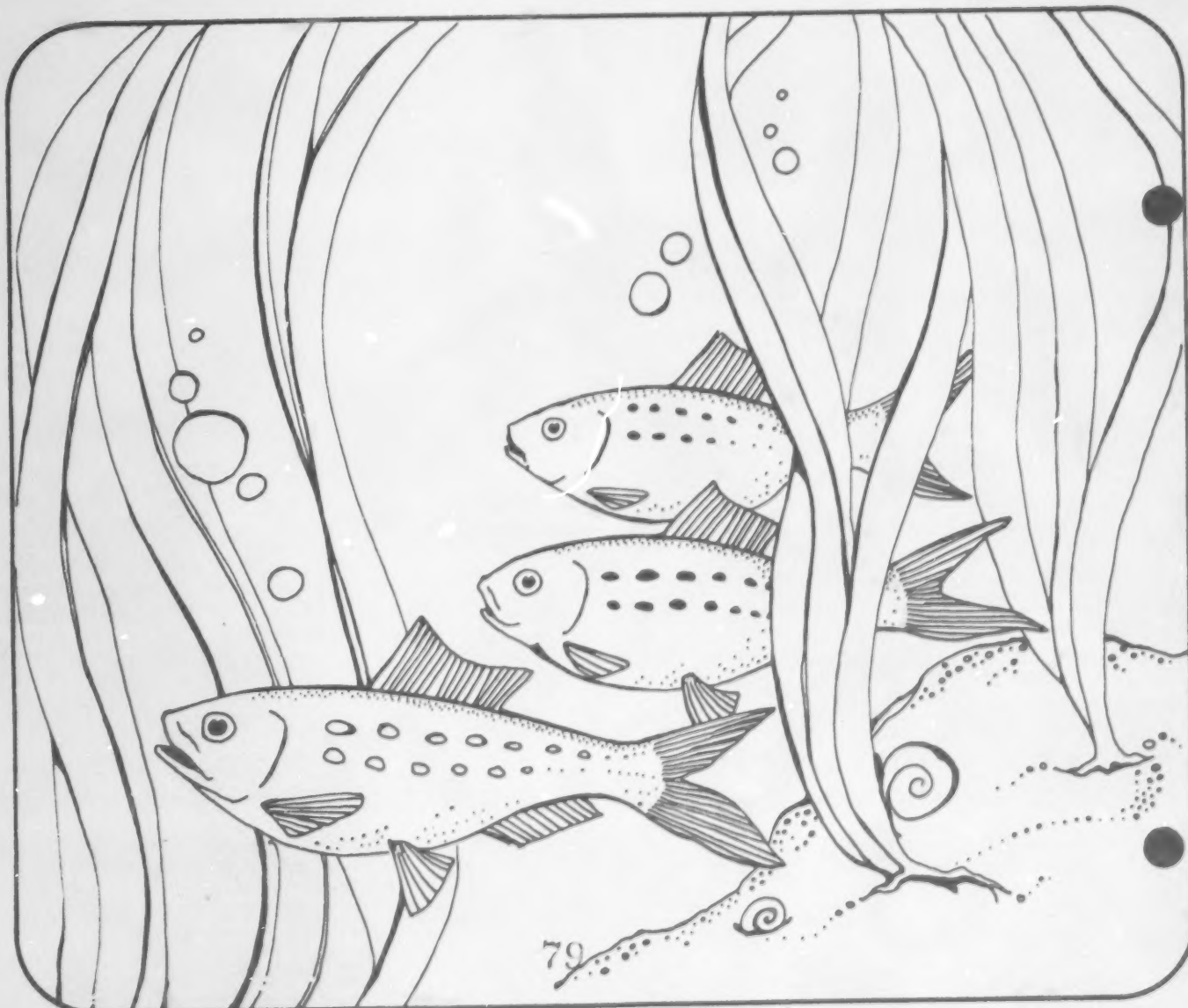
"Adaptation: Predator/Prey," Outdoor Biology Instructional Strategies,
University of California, Berkley, 1975

Credit

Steve Gold, contributor

The activity is based on a Predator-Prey game used by the staff at the Greenwich Audubon Ecology Workshop.

Notes To Myself



Niche Switch

Curriculum Topic

BIOLOGY, ECOLOGY, ENDANGERED SPECIES

Subject

Science, Social Studies

Environmental Topic

ECOSYSTEMS

Grade Level(s)

5 - 8

Site

Classroom

Skills

Collecting and compiling data,
inferring from data,
interpreting data

Author

Karen Hayward
William McCann

Objective

The student will be able to:

1. identify the different components of each niche studied,
2. list the different requirements of the animals who inhabit these niches.

To The Teacher

The actual location where an animal lives and performs certain functions is called its habitat. The combination of functions and habitat is this animal's ecological niche. The term niche refers to the animal's total role within a biological community, whereas the term habitat only refers to a specific location.

The concept of "Niche" is sometimes difficult to illustrate to a student. By centering an activity around an actual example of a niche, the students will be able to relate and obtain a more thorough understanding of what an ecological niche is, and how specific and important it is. The easiest way to differentiate habitat and niche is to think of the habitat as the address of the animal and the niche as its occupation.

The students will select two different animals. Each animal will be analyzed, a list of characteristics of that particular niche will be enumerated and the ecological role will be evaluated.

Note: This activity infuses nicely when students are studying World Geography and the different human niches throughout the world.

Before You Begin

Preparation: A discussion of different human environments throughout the world might precede this activity.

Materials: Students will need paper and pencils.

Words To Know

niche, habitat



"AND STOP USING THE TERM 'SCAVENGER'!
WE'RE 'ANTI-POLLUTANT ENVIRONMENTAL
CONTROLLERS'!"

Conservation News 8-1-76

ACTIVITY

1. Explain what a niche is to the students.
2. Have the students brainstorm different animals and their niches.
3. Write these animals and niches on the blackboard.
4. Have each student select two animals and their niches.
5. Have students describe each animal's niche on a sheet of paper at his or her desk. Please see Table I for an example:

	Monkey	Kangaroo Rat
Habitat	Tropical Forest	Desert
Food	Vegetarian (a tropical forest has a lot of plants)	Omnivorous (eating all kinds of foods--this is helpful because food is scarce in a desert)
Transportation	Aerial Climber	Sand and Tunnel Traveler
Specialities		Very efficient kidneys so it never has to drink water

6. Ask each student to have their animals switch niches. Can the animal survive in its new niche? What are its problems? Why? Have the students write their answers underneath their list.
7. Have students discuss the problems. Write these on their paper. Example: a frog may be able to live in a fish's environment, yet fish cannot live in all of a frog's environment.
8. Each student should have the opportunity to explain what niches they have worked with and their conclusions.
9. How has one adapted to succeed over his competitors?
10. Show why niches are specific to certain animals. Relate, food chains, food capture processes, locomotion, defense, and morphological differences.

Related Activities

Discuss the fact that many niches left by extinct animals remain unfilled. Provide resource books and encourage students to make a list of extinct species.

What Happens to Animals After They Die?

Curriculum Topic

ECOLOGY

Subject

Science

Environmental Topic

ECOSYSTEM

Grade Level(s)

4 - 6

Site

Classroom

Skills

Observing, analyzing information,
concluding

Author

Orah Elron

Objective

The students will be able to:

1. explain the part of decomposers in the food web,
2. describe by diagram the position of decomposers in the food pyramid (or food cycle).

To The Teacher

When students first learn about food chains and the food web in nature they tend to see only producers (plants) and consumers (animals). They do not recognize that decomposition is also a vital part of the cycle of life. Students who raise animals at home, especially small animals as for example fish in an aquarium, know death. But do they connect this with the recycling of living matter as part of the food web?

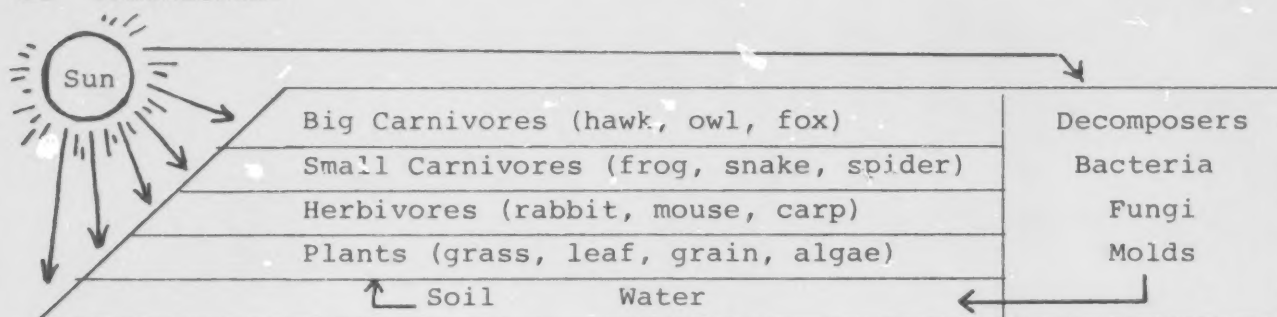
In the following simple experiment students encounter decomposition by molds and bacteria. Even young students have seen mushrooms and fungi in the woods. They may also know that food left outside the refrigerator decomposes. They have seen molds on fruit or spoiled bread. In this activity the student watches the decomposition of a dead fish or dead plant through the "window" of a tightly closed glass jar. They can follow the process without any side effects such as the smell of decay.

They will infer that tiny organisms feed on the dead animals and plants until they appear to disappear. Then they will be led to understand that the decomposed organisms become food for new plants. (You can tell them about compost, if possible show them how compost is used in a garden.) Students will learn that decomposers return the dead organisms to the food cycle, they "recycle" dead animals and plants.

At the end of this activity, after at least 4 weeks, you can ask the students:

1. What is the part of the decomposers in the food chain (food web)?
2. What would happen in a world without decomposers? How would the woods, the garden look?

If the students have drawn food webs before, ask them to add the decomposers to their picture. You could use the following diagram as conclusion:



Before You Begin

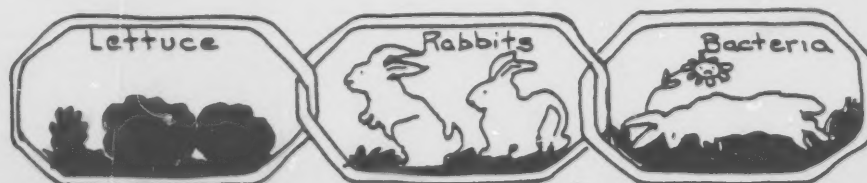
It is advisable to work in small groups of 3-5.

Materials: for each group; small dead organism (guppy or other fish from aquarium, dead tadpole or worm, and/or dead plant), 1 clear glass jar with tight screw on cover, enough sand to fill each jar 2/3 full, plastic cup, plastic spoon, paper labels, 3 "control" glass jars with cover and sand, 2 plastic "fish" (or other little toy animal)

If this activity is not part of a larger unit, introduce the food chain and food web before starting.

Words To Know

decay, decomposition, bacteria, fungi, molds, food web, food chain, cycle of organic matter in nature



ACTIVITY

1. In a young class it is advisable to show the students exactly what they will do: first examine the fish (or other dead organism) thoroughly. Measure it, write down its color and skin patterns. Will the animal change?
 2. Give each group the equipment and worksheet so that they are able to work alone without help from the teacher. Remind student to label each jar.
 3. Decide where the groups can place their experiment, so as to observe it easily.
 4. Introduce the subject of control in an experiment. What controls will we need in this experiment?
 5. Have one student from each group form a new group for control jars. What parts of the experiment must be controlled: the dead organism, the sand. The students will prepare the 3 control jars:
 - a. one jar of dry sand to bury dead fish (Why?)
 - b. one jar of wet sand to bury plastic toy animal (Why?)
 - c. one jar of dry sand to bury plastic toy.
- Control jars will be placed on the same shelf for all groups to observe. Students could discuss their hypothesis: What will happen in the control jars? What will happen in the other, wet sand jars?
6. Students will write their observations weekly on the worksheet. After 3-4 weeks summarize the observations with the whole class. (See To The Teacher)
 7. Discussion Questions:
 - a. What are the changes they observed in jars with plant and fish buried in wet sand? After first week? After two, three weeks? After four to five weeks?
 - b. What do students give as cause for these changes?
 - c. Did students observe similar changes in the control jars? Toy in dry sand. Toy in wet sand. Fish or plant in dry sand. How can they explain the differences?
 - d. What happened to the decayed material? (It became food for fungi and bacteria) Did students notice changes in the color of the sand?
 - e. What happens to decayed, dead, organisms in nature, in the woods, fields?
 - f. What would happen if dead organisms did not decay? It is important to stress the cycle of organic matter in this activity. Students will learn that death is a normal part of the life cycle.

Related Activities

See "The Good Bacteria" another activity in this notebook.

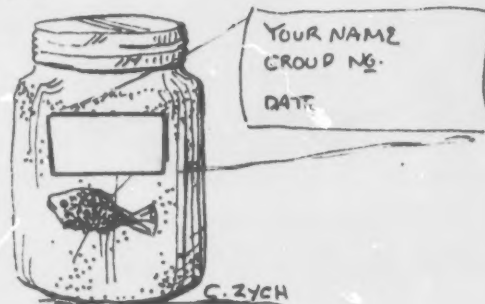
Credit

Elron, Orah and Amelia Terkel. "Our Aquarium", Matal, Tel Aviv University, 1977.

Drawing: Cecelia Zych

STUDENT PAGE

1. FILL THE GLASS JAR WITH CLEAN SAND. WET THE SAND THOROUGHLY, BUT DON'T LET ANY SURPLUS WATER STAY IN THE JAR.
2. PLACE THE DEAD FISH AND DEAD PLANTS UNDER THE SAND SO THE YOU CAN SEE THEN FROM OUTSIDE THROUGH THE GLASS.
3. CLOSE THE JAR TIGHTLY.
4. PUT A LABEL ON THE JAR WITH:
YOUR NAME, NUMBER OF
YOUR GROUP (A, B, C...)
DATE OF BURIAL
5. WRITE ON THIS WORKSHEET:
A. DESCRIPTION OF DEAD ORGANISMS WHEN WE BURIED THEM:



AFTER ONE WEEK:

AFTER TWO WEEKS:

AFTER THREE WEEKS:

AT END OF EXPERIMENT DATE:

6. WHAT DO YOU THINK WOULD HAPPEN TO THE FISH IF WE LOOKED AT THEM AFTER 10 YEARS? WHAT WOULD WE SEE?

Raising Brine Shrimp

Curriculum Topic

OCEANOLOGY

Subject

Science

Environmental Topic

ECOSYSTEMS

Grade Level(s)

6,7

Site

Classroom

Skills

Observing, experimenting

Author

Paul Kubicza

Objective

The student will be able to:

1. describe the life cycle of brine shrimp
2. identify the factors necessary for the development of brine shrimp.

To The Teacher

Brine shrimp (Artemia) are tiny crustaceans that can be cultured easily from eggs. They are excellent food for small carnivores such as sea anemones, croals, barnacles, and small fish. They are sometimes called "sea monkeys".

Brine shrimp live naturally in very salty water. They are found in salty bodies of water such as Epson Lake, Washington and the Great Salt Lake, Utah. Resting eggs, laid by the shrimp, float in the briny water and are blown to the edge of the lake shore where they dry out. These eggs will not hatch until they are first dried. They remain hatchable for several years. Eggs are collected in great quantities at the edge of these lakes and are sold in pet stores packed in vials of 1/4 oz. to 1 oz. Eggs from San Francisco Bay area are the best.

To test if eggs are good and will hatch, float them in water. The ones that sink are the best ones. Hatch eggs in shallow open containers because they can be harmed by concentrations of carbon dioxide. The eggs will hatch in any salt solution that does not contain too much potassium.

Once the eggs hatch, the young larva (nauplius) will soon be swarming in jerky swimming motions. In four to five days the brine shrimp begin to swim with a smooth motion signaling the emergence into adult form. If you can keep the brine shrimps living and growing for three weeks the females will produce live young of their own. As this generation grows up it will produce eggs. The eggs will then hatch only if first dried for a period.

Green algae is all the food needed to feed shrimp and keep them growing. If you grow the shrimp in artificial salt water, feed them granular or cake yeast mixed with water.

This activity will show how brine shrimp thrive in a high saline environment in which most organisms could not exist. Environment is the sum total of all factors living and non-living that influence an organism. The Great Salt Lake in Utah contains almost 25 percent salt. Of the thousands of species of animals that live on our planet, only two species can exist in the extreme salt content of the Great Salt Lake. They are the brine shrimp and brine flies. Also there are a number of salt-loving (halophilic) bacteria and algae.

Forms of life have adapted to the high pressure in the depths of the ocean and extreme temperatures of hot springs and glaciers. Brine shrimp are one of the few species that have adapted to a high salt environment.

Before You Begin

Materials: brine shrimp eggs, tap water or pond water, coarse salt, jar, granular or cake yeast

The following chart can be used to determine the jar size and amounts of water, salt, and eggs to use:

Tap or Pond Water	Coarse Salt	Brine Shrimp Eggs
1 quart	2 tablespoons	1/4 teaspoon
1 gallon	8 tablespoons	1 teaspoon
2 gallons	16 tablespoons	2 teaspoons
5 gallons	40 tablespoons	5 teaspoons

Words To Know

brine shrimp, Artemia, salinity, larva

ACTIVITY

1. Use a jar of right size and add correct amount of salt and water using table in previous section.
2. Stir until the salt dissolves.
3. Add brine shrimp eggs. Do not crowd the eggs.
4. Use an aquarium bubbler to keep the eggs in motion or stir twice a day.
5. Eggs hatch in 24 to 36 hours, depending on temperature of the water. Up to 27°C - the warmer the water, the sooner they will hatch.
6. Observe the jerky swimming motions and appearance of the young larva.
7. Feed shrimp granular or cake yeast mixed with just enough water to make it into a solution. Feed a few dropperfuls of this mixture to shrimp until water becomes milky. When brine shrimp eat enough to clear the water, add more.
8. Observe the growth of brine shrimp into adult form.
9. The following discussion questions may be of value:
 - a. What do brine shrimp look like?
 - b. Describe the development of brine shrimp from eggs.
 - c. Describe the type of environment in which brine shrimp grow.
 - d. Can other plants and animals live in a high salt environment? What are they?
 - e. What type of food do brine shrimp eat?
 - f. Do you think brine shrimp can live in an environment without salt? How can you prove it?
 - g. What are the variables in your environment which if changed would make your existence impossible?

Related Activities

1. Use natural seawater and algae to raise the shrimp. Place a dish of seawater with eggs in a sunny window and within a few days green algae will grow in great quantity. This is all the food the shrimp need to keep them growing.
2. Experiment with phototropism. If you shine a light beam into the dish the brine shrimp will swim toward the light. They will concentrate in the light beam and you can collect them with an eye-dropper.
3. Experiment with growing brine shrimp in solutions of varying salinity - from pure tap water to thoroughly saturated salt water.
4. Use the brine shrimp for food for marine animals in an aquarium. You can collect the brine shrimp with a fine mesh net.

Resources

Philp, R. T., "Jewel Marine Aquarium Laboratory Manual", Jewel Industries Inc., 1976, EEC #1132.

"The Source Book of Marine Sciences", Department of Education, Tallahassee, Florida, 1970, EEC #1071.

Weyl, P., Oceanography: An Introduction to the Marine Environment, John Wiley and Sons, 1970, pp. 400-401.

Zahl, Paul A., "Life in a Dead Sea - Great Salt Lake", National Geographic, August, 1967, pp. 256, 261-262.

Credit

Waters, B. S., "Ocean In Your Classroom, Part III, Activities", Massachusetts Cooperative Extension Service - Southeast Region, EEC #1110.

Notes To Myself

pH and Plant Growth

Curriculum Topic

CHEMISTRY

Subject

Science

Environmental Topic

ECOSYSTEM

Grade Level(s)

7,8

Site

Classroom

Skills

Experimenting, collecting,
compiling, and interpreting
data

Author

Paul Kubicza

Objective

The student will be able to:

1. analyze the relationships between soil pH and plant growth.

To The Teacher

This activity is designed to show students the importance of the chemical environment in which an organism lives. In the activity, the test organism will be a plant.

Soils are classified in three distinct groups: acid, neutral and alkaline. Simple tests reveal to which of these groups any soil belongs. The cause of soil acidity can be traced to the fact that alkaline materials are lost from cultivated soils-principally through leaching, and to a smaller extent, by absorption by plants. These alkaline materials are, for the most part, calcium and magnesium, each of which can easily be replaced in the soil by the addition of lime.

To measure the acidity of soils, a pH-level system is employed. Soil pH is classified as follows:

Intensely Acid	pH	1 - 4
Moderately Acid	pH	5
Slightly Acid	pH	6
Neutral	pH	7
Slightly Alkaline	pH	8
Moderately Alkaline	pH	9
Intensely Alkaline	pH	10 - 14

This gives a simple reference scale for the classification of soil according to pH value. The pH level of the soil not only has an important bearing on its bacteriological and chemical vigor, but also greatly affects the tone and characteristics of the growing plant.

Plants have narrow pH tolerance limits within which they thrive. Most common plants such as corn, lettuce, tomatoes, and rye grass prefer a soil pH of 6.0 to 8.0. There are plants which desire a slightly acid pH of 5.0 to 6.0. These include lima beans, potatoes and strawberries. Other plants prefer a moderately acid soil pH of 4.0 to 5.0. These include the Venus fly-trap and mountain ash. The "LaMotte Soil Handbook" lists common plants and their preferred pH levels.

Before You Begin

Materials: soil (approximately 200 cm³ per student), seeds (preferably fast growers such as beans, radishes, lettuce, or marigolds), milk cartons (1 per student - 1/2 pint size), soil pH test kit or pH test paper (if unavailable see Related Activities), lime, sulfur powder, spoons, buckets for soil disposal, dustpan and brush, scissors, rulers

Preparation: Use a soil pH test kit or pH test paper to determine the pH level of your soil. Hydrion is an excellent brand of pH test paper. Test paper with a pH range from 3 to 9 would be adequate.

Divide the soil into three equal portions. Add lime to one portion in a large enough quantity to make it moderately alkaline. Add powdered sulfur to another portion in a large enough quantity to make it moderately acidic.

Use the soil pH test kit or pH test paper to determine pH levels of the acidic and alkaline soils.

Have students bring in milk cartons in which they can grow plants.

Words To Know

soil, pH, acid, alkaline, germination



ACTIVITY

1. Introduce or review the meaning of pH, acid, and alkaline.
2. Explain to the class that they will investigate the effect of soil pH on plant growth. Each student will grow seeds in his/her milk carton.
3. Divide class into three groups. One third of the students will grow their plants in unaltered soil, one third in acidic soil, and one third in alkaline soil.
4. Instruct the students to do the following:
 - a. Cut off top of milk carton.
 - b. Fill carton one half full with soil. Poke 2 holes in the bottom for drainage.
 - c. Add water to moisten soil.
 - d. Plant seeds according to directions on package. Plant 4 seeds per carton.
 - e. Label carton with student's name, date, and pH level of soil.
 - f. Keep on a counter, window ledge, or table in the room.
5. Students are to check their plants before class each day for approximately 30 days. They should record the date of germination, changes in plant height and generally, in plant vigor and helath. Soil should be kept moist.
6. Study the class results. You can use the chalk board or an over-head projector to display them, arranging them in the form of a chart:

	Soil A	Soil B	Soil C
Number Seeds Germinated			
Plant Height (final)			
Health & Vigor (good, fair, poor)			

The following questions may be of value in discussing the results:

- a. Which soil had the best germination rate?
- b. In which soil did the plants grow the highest?
- c. In which soil was there the largest number of healthy, vigorous plants?
- d. Does the pH of the soil have any effect on plant growth?
- e. Which of the three soils is best for plant growth?
- f. Do you think that this soil is the best soil for all plants?

Related Activities

1. If the methods of soil pH determination are unavailable, obtain a soil that you know is healthy. Divide it into 3 portions. Add 30 cm³ of lime per 1000 cm³ of soil to one portion and call it alkaline. Add 30 cm³ of sulfur powder per 1000 cm³ of soil to another portion and call it acidic.

2. Investigate the use of lime in a garden or on a lawn. (Visit hardware and garden shops for information, e.g.)
3. Repeat the experiment at home with other types of plants.
4. Have students bring in soil samples from home and test them for pH.
5. Test other aspects of the soil environment such as water content, humus content, porosity, permeability, and particle size.
6. Study and compare the preferred pH requirements for different plants.
7. Study other factors which influence seed germination.
8. Bring soil samples for testing to the Connecticut Agricultural Experiment Station in New Haven.
9. Graph the plant height (y axis) versus days (time - x axis) and compare the growth in soils having different pH levels.

Common Plants and Their pH Preferences

<u>Plant</u>	<u>Soil pH Preference</u>
Asparagus	6.0 - 7.0
Beets	5.8 - 7.0
Bluegrass	6.0 - 8.0
Broccoli	6.0 - 7.0
Cabbage	6.0 - 7.0
Cauliflower	6.0 - 7.0
Carrott	5.5 - 6.5
Corn	6.0 - 7.0
Cucumber	6.0 - 8.0
Lettuce	6.0 - 7.0
Lima beans	5.5 - 6.5
Onion	6.0 - 7.0
Peas	6.0 - 8.0
Pepper	6.0 - 6.5
Potato	4.8 - 6.5
Radish	6.0 - 8.0
Spinach	6.0 - 7.0
Squash	6.0 - 8.0
Strawberries	5.0 - 6.0
Tomato	6.0 - 7.0
Turnip	6.0 - 8.0
Watermelon	6.0 - 7.0
Wheat	6.0 - 7.0
Zinnia	6.0 - 8.0

Resources

"LaMotte Soil Handbook", LaMotte Chemical Products Company,
Chestertown, Maryland.

Project Learning Tree; The American Forest Institute, Washington, DC
EEC # 400.3

Rasmussen, F., P. Holobinko, and V. Showalter, Man and the Environment;
Houghton-Mifflin Company, 1974, pp 134-164.

"Soil Testing", The Connecticut Agricultural Experiment Station, New
Haven.

Notes To Myself

The Good Bacteria

Curriculum Topic

HEALTH, BIOLOGY

Subject

Science
Home Economics

Environmental Topic

ECOSYSTEM: The interaction of plants, animals and their non-living environment form many cycles in an ecosystem.

Grade Level(s)

7 - 8

Site

Classroom

Skills

Locating and obtaining information
Measuring

Author

Maryann Cronin Horgan

Objective

Students will be able to:

1. distinguish between harmful and beneficial bacteria
2. make yogurt as an example of how man uses beneficial bacteria.

To The Teacher

It is impossible to set a monetary value on the services of some 1250 known harmless and beneficial species of bacteria. Whether free in the soil or harbored in nodules of the roots of plants, they capture nitrogen from the air and incorporate it into compounds that are essential nutrients for higher plants. Bacterial partners aid in digestive processes of most and perhaps all animals. Bacteria serve as food for many animals, such as clams. Further, bacteria simplify the organic compounds from the bodies of dead plants and animals, and from animal wastes, making still further nutrients available for multicellular organisms. A list of beneficial bacteria which the class may construct: Nitrogen-fixing bacteria (found on nodules of legumes, alders, bayberries and cycads; synthesize nitrogen compounds from nitrogen in atmosphere).

Bacteria in gut of animals and man (in man, some produce vitamin K, essential to blood-clotting and important in ruminants, such as cows, for initial breakdown of cellulose).

Bacterial action in sewage disposal (septic tanks and public sewage treatment plants digest sludge) is essential step in sanitation and prevention of disease.

Economically-important bacteria:

Food preservative (sauerkraut)

Dairy industry (limburger cheese, Swiss cheese, yogurt)

Wood alcohol (ethyl alcohol)

Commercial tea, coffee and cocoa

Putrefaction, bacterial decomposition of protein, responsible for tanning of leather, freeing fibers from hemp, flax and other plants.

For the yogurt-making activity, it is suggested that a Salton Yogurt-Maker (or similar model) and instructions be used. If one cannot be borrowed, an incubator could be used to keep the milk warm enough for the culture to grow.

Before You Begin

Materials: yogurt-maker (Salton) or incubator, one container plain yogurt, tablespoon, one quart milk, condiments (jams, jellies, honey, wheat germ, walnuts, raisins, etc.)

Yogurt-making Recipe:

Bring quart of milk to point of boiling.

Cool.

Add 1 tbsp yogurt culture. Mix well.

Pour into jars. Cover.

Keep jars warm (93 degrees C or 200 degrees F) for 5-10 hrs

Refrigerate jars 3-4 hours.

Add fruit, nuts-whatever you like and EAT!

Words To Know

bacterium, bacteria, legume, fermentation, culture, nitrogen



ACTIVITY

1. Ask students to list types of bacteria which are beneficial to other living things. Ask them next to make a list of ways in which bacteria are beneficial.
2. Make and eat yogurt!

Related Activities

1. Visit a health food store to learn why yogurt is considered to be such a healthy food.
2. Diagram the nitrogen cycle. Explain why nitrogen-fixing bacteria are so important to human life.
3. Examine bacteria cells, legume nodules, etc. under a microscope.

Resources

Milne, L.J. and M., The Biotic World and Man, Prentice Hall, Inc., 1965, pp. 264-9

Notes To Myself

Soil Bacteria

Curriculum Topic

EARTH SCIENCE

Subject

Science

Environmental Topic

ECOSYSTEMS

Grade Level(s)

7

Site

Classroom

Skills

Experimenting, observing

Author

Paul Kubicza

Objective

The student will be able to:

1. identify certain types of bacteria as beneficial.
2. experiment with soil from his home and determine whether or not the soil contains bacteria.
3. examine the interdependence between soil bacteria and plants.

To The Teacher

When you mention the word bacteria to most students they think of a very contagious, disease-causing microorganism. This activity will make the student aware of the presence of bacteria in soil and the importance of this bacteria to plant growth.

Soil bacteria have a number of functions which include decomposition, nitrate-formation, and nitrogen-fixing.

Soil bacteria decompose the dead bodies of plants and animals, reducing them to water, carbon dioxide, ammonia, and simple mineral compounds. Essential elements are thus returned to the soil. Further, decomposition forestalls the accumulation of dead plant and animal debris.

Nitrogen (N_2) found in soil usually exists almost within the organic matter. As gaseous nitrogen, however, it is not available for use by the plants directly. There are groups of soil bacteria that oxidize this organic matter and turn it into nitrates. Nitrates are soluble in water and can be absorbed into plant roots. These groups of soil bacteria are, therefore, essential to plants to whom they provide vital nutrients.

There are also groups of nitrogen-fixing bacteria in the soil that utilize atmospheric nitrogen and transform it into forms which can be used by plants. The nitrogen-fixing bacteria grow around the roots of many plants. Legumes, including peas, beans, alfalfa and clover, are a family of plants that have nodules of these bacteria on their roots.

Thus bacteria and plants are dependent on one another. Dead plant material provides food for bacteria. The bacteria produce and release nitrates, ammonia, and other compounds essential to new plant life. This cycle is a good example of the interdependence of living things.

Before You Begin

Materials: petri dishes, nutrient agar, graduated cylinders, beakers, spoons, buckets (for soil disposal), magnifying glasses, tape, autoclave (optional)

The class will need a number of agar plates, preferably one per student. Add 23 grams of nutrient agar to one liter of water. Mix until a uniform suspension is obtained. Heat with frequent agitation and boil for one minute. Fill the petri dishes about half full with the agar. Sterilize by autoclaving at 121°C . Use care to prevent contamination if you do not sterilize the petri dishes.

Caution: Pathogenic organisms can be picked up and cultivated on simple nutrient agar. After you/students have been exposed to soil, therefore, tape the plates closed. Only when the petri dishes are sterilized should they be opened and washed. To avoid contact, disposable plastic petri dishes are recommended.

Words To Know

soil, bacteria, nitrate, decomposition, nitrogen, organic, agar

ACTIVITY

1. Ask students to bring in soil samples from home. (Avoid this activity in winter when the ground is frozen.)
2. Instruct students to mix 1 teaspoon soil with 25 ml water in a beaker.
3. Students are then to inoculate their plates by streaking 8-10 drops of soil-water mixture across their agar. They are to leave part of the plate uninoculated as a control. Caution them to avoid breathing on the agar. Seal plates with tape, on which students record name and date.
4. Incubate in any closet or cabinet in the room at room temperature for 48 hours.
5. After 48 hours, ask students to observe the petri dishes and record their observations. Use magnifying glasses. Instruct students not to remove covers. The following questions may be of value:
 - a. Did anything grow?
 - b. What does it look like?
 - c. Look through the magnifying glass. What do you see?
 - d. Did anything grow on the unstreaked region?
6. Collect plates, Use care in disposing of bacteria and agar. Sterilize (not simply wash) all petri dishes.
7. Post-lab discussion should follow. The following questions may be of value:
 - a. Individual bacteria are too small to be seen with a magnifying glass. Did you observe any colonies of bacteria on your petri dishes?
 - b. Is there bacteria in the soil?
 - c. Did all students have bacteria in their soil?
 - d. What was the purpose of the control section that was not inoculated?
8. Discuss the role of soil bacteria in the nitrogen-cycle. Emphasize the fact that not all bacteria cause disease. Some are very beneficial. Also emphasize the interdependence between plants and bacteria.

Related Activities

1. Compare the amounts of bacteria found in different soil samples.
2. Prepare slides to observe some of the bacteria under a microscope.
3. Study other characteristics of soil such as porosity, permeability, water content, humus content, particle size, and pH.
4. Explore beneficial use of microorganisms by man in the making of: wine, bread, beer, cheese and yogurt as an antibiotic product and for insect control.
5. Investigate diseases caused or aggravated by the presence of bacteria.

Resources

Biological Science: An Ecological Approach; PSCS Green Version, Rand McNally, 1973, Chapter 7.

LaMotte Soil Handbook; LaMotte Chemical Products Company, 1962, pp 5-13.

Stanter, R., Doudoroff, M., and E. Adelberg, The Microbial World; Prentice-Hall, Inc., 1963, pp 528-540.

Stone, A. and L. Sherman, Spaceship Earth-Life Science; Houghton Mifflin, 1975, pp. 176, 266.

Notes To Myself

Snowed Under

Curriculum Topic

EARTH SCIENCE

Subject

Science

Environmental Topic

ECOSYSTEMS

Grade Level(s)

7-8

Site

Outdoor snow, covered area

Skills

Collecting, compiling, and graphing data, measuring observing

Author

Pat Perrella

Objective

Students will:

1. gather data which illustrate the insulating effects of snow
2. plot graphs to show the effect on snow temperatures of different variables
3. investigate relationships between the survival of small animals and snow depth and temperature
4. design and construct snow caves to be heated

To The Teacher

Snow performs a very important role in protecting plants and animals from freezing. Because snow is a poor conductor of heat, it has the capacity to insulate the soil underneath it. Soil temperature will be higher, therefore, under a cover of snow than it would be without it. Temperatures under the snow at the soil surface have been measured to be 15-32 degrees F warmer than soil without snow protection. The protection afforded by snow has enabled small mammals to survive in winter in regions where, without its warming influence, these animals would perish. This, in turn, ensures the survival of larger, carnivorous animals such as arctic fox, ermine, weasel and sable who feed on the smaller animals.

Humans also take advantage of the insulating effects of snow. The classic example is the Eskimo igloo which, when properly constructed, can be quite comfortable even when outside temperatures are well below freezing. Campers build snow caves to insulate themselves from freezing temperatures. Pockets of air in the compacted snow provide good insulation. The inside of the caves can be tiered, the highest tier used for sleeping. Colder denser air will fall away toward the lower levels.

Before You Begin

Each student team (2-3 students) will need the following equipment:

thermometer - accurate to one degree F or .5 degree C. (Tie on a long, colored yarn to prevent loss in snow); one-half inch diameter candle and matches; metersticks or yardsticks; copies of Student Page (data sheet); graphing paper, question sheet.

Select a site large enough to accommodate teams of students working along a line with 10-20 foot spaces between teams. It should include sheltered areas (woods), exposed areas (fields), and, if possible, a hillside with both north and south faces. Select your stations beforehand and mark them with numbered sticks.

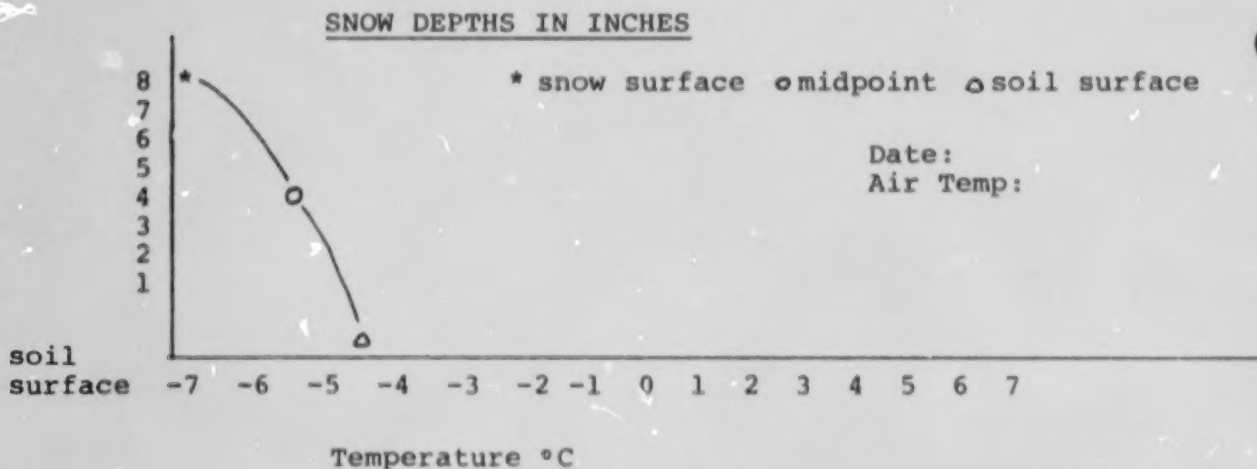
You will need to introduce the term "insulator" and instruct students on the correct way to take temperatures. Warm hands should not hold the thermometer. It is best to set the thermometer down and wait for the indicator to stop moving before a reading is taken. Warmth from the sun can give a false reading, so measure with the thermometer in a shadow. A wet thermometer will be cooled by evaporation and give a false reading. When taking cave temperatures, thermometers should be shaded from the candle flame so as not to measure radiant heat.

Words To Know

insulator

ACTIVITY

1. Proceed with class to selected sites and assign to each team one specific area.
2. Direct students to follow Data Sheet, recording temperatures from different snow depths as indicated. (The illustration on the Data Sheet will help them.)
3. On Data Sheet: Instruct each team to make a record of every evidence of small animal activity that can be found within the assigned area. (tracks, bits of fur, tunnels, carcasses or parts of carcasses)
4. Conduct a contest to see which team can design a snow cave that can be heated to the highest temperature. Two limitations on the design are that the heated part of the caves cannot be less than 1 cubic foot in size and that only candles can be used for heating.
5. Return to the classroom to discuss the snow-cave designs. Try to have students consider what design elements caused high or low temperatures.
6. Have each team collect information from all other teams to complete Data Sheet for all stations.
7. On graph paper have each team record own findings as in the sample below:



More appropriate depth and temperature intervals can be selected. (On an unusually warm day, the slant might go in the opposite direction).

8. Have students answer question sheet.

Related Activities

Another investigation requires that students find a location near the school where daily temperatures of undisturbed snow can be taken for a sequence of several days. They then study the fluctuation of snow and soil temperatures in comparison to the daily fluctuation in air temperature.

Resources

"Snow Temperatures" "Outdoor Classroom Environmental Education Guide," U.S. Fish and Wildlife Service, #5, 1975 EEC #1081.

Notes To Myself

Data Sheet

SIDE ONE

Outdoor Classroom Guide Number 5

Snow Temperatures

Names

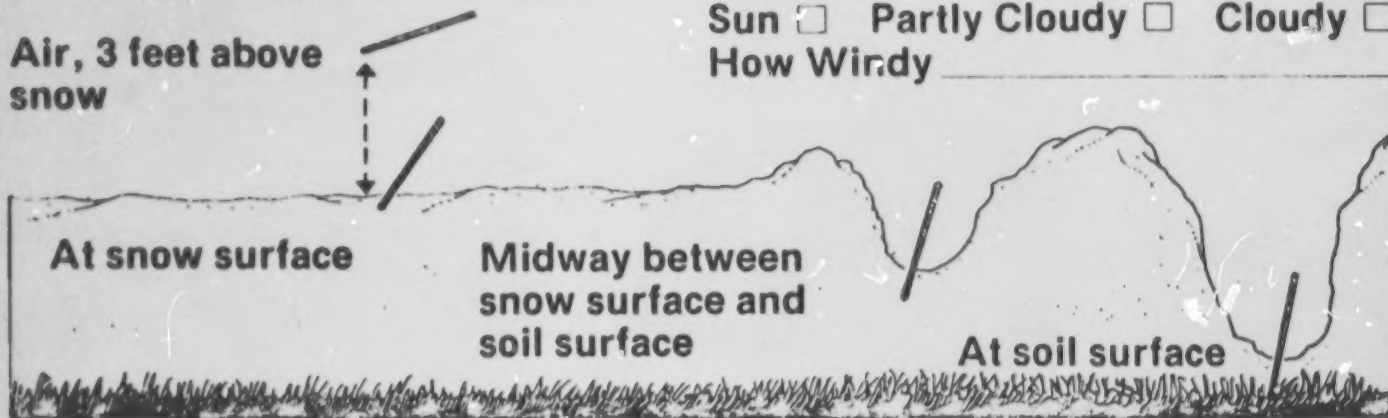
TEMPERATURE READINGS:

Air, 3 feet above snow

Station Number _____ Date _____

Sun ☒ **Partly Cloudy** ☐ **Cloudy** ☐

How Windy



Station	Description of Site	Air Temp. 3 ft. above snow surface	Temp. at snow surface	Temp. at mid-way	Temp. at soil surface	any evidence of animal activity?

STUDENT PAGE

Question Sheet:

1. Why were stations in different types of environments (wooded areas, open fields, sides of hills) chosen?
2. Refer to your Data Sheet. At which depth (air temperature, snow surface, midway to soil, soil surface) did the temperature vary the most from station to station? Can you determine why?
3. At which station did team members find the greatest temperature change among those 4 depths? Where was that station located? Why the variation there?
4. Did you find any relationship between the presence of animals and snow depth? Location of station?
5. Look at your graph and explain the direction of the line's slant.
6. Are there people who use snow as insulation in building their homes?
7. How do most Americans insulate their homes?
8. Would you say, after these investigations, that snow is a good insulator?

Suntans & Ricketts

Curriculum Topic

BIOLOGY

Subject

Science

Environmental Topic

ECOSYSTEM - The interaction of environmental and biological factors determines the size and range of species and populations.

Grade Level(s)

6 - 8

Site

Classroom

Skills

observing
researching and evaluating information

Author

Maryann Cronin Horgan

Objective

The student will be able to:

1. recognize the physical variations among human races,
2. explain the interrelationship between skin color and Vitamin D production,
3. and identify physical adaptations in humans to different environmental conditions.

To The Teacher

Each environment poses distinct problems of survival and reproduction for the species present. The summed rigors of the environment constitute "natural selection". Organisms of different genetic constitution vary in survival rate and reproductive ability, depending on the environmental selective pressures. The result is a continual evolution in which organisms come to be supremely well adapted to their surroundings. Those organisms that are well adapted are said to be "fit", from Darwin's term, "survival of the fittest". Because environments may be so different, it is not surprising that individuals of the same species may evolve striking differences in appearance and/or behavior if they live in different parts of the world.

The exact steps in the evolution of man are not known, but the many forms which make up the component elements of the three great races of mankind evolved slowly. A race is generally regarded as a group having certain physical characteristics in common. These characteristics are not fixed, however, and all racial traits overlap between the groups. Most anthropologists recognize the white race, the yellow-brown race, and the black race as the three great races in which most of the present-day population of the world can be classified." Before the changes in transportation and society which have, in recent times, caused large upheavals in the distribution of mankind, the white or Caucasoid race was native to Europe, North Africa, the near East and India. The black or Negroid race was indigenous to Africa, Melanesia, and New Guinea. The yellow-brown or Mongoloid race originated in Asia and the Americas.

Skin color in humans is derived from the amount of melanin (pigment) in skin and hair. More exposure to ultraviolet light causes more melanin to be produced. As well as protecting our skin from too much ultraviolet light (sunburn, skin cancer), melanin prevents the skin from producing too much vitamin D. It has been found that excessive amounts of vitamin D cause lumps of minerals to build up on bones, a potentially fatal condition. A deficiency of vitamin D leads to the disease of ricketts (soft bones, crooked spine, bowed legs). Man has helped to prevent ricketts by fortifying milk with vitamin D and by supplementing the food diet with cod liver oil and vitamin pills. Light-skinned peoples living in a climate of intense sunlight protect themselves from overexposure by wearing clothing and using sunscreens.

Before You Begin

Materials:

1. slides or pictures from books or magazines showing races and sub-races of humans,
2. a list of human races and their attributes (e.g., Caucasoid, Mongoloid and Negroid),
3. research materials on ricketts and vitamin D,
4. question sheet (Suntans and Ricketts).

Words To Know

adaptation, vitamin D, melanin, ricketts, deficiency disease, fortified milk, ultraviolet light, natural selection, migration, environment, gene pool, race

ACTIVITY

1. Teacher will show pictures of various human races.
2. Students will investigate the importance of skin color to the production of vitamin D. This can be done through lecture, discussion and/or individual reports.
3. Students will answer questions from Suntans and Ricketts ditto.
4. Students will make a collection of pictures of various human races for a bulletin board display or class collage. Label each picture with the beneficial adaptations which suit the population to its environment. Teacher may encourage analysis of pictures with questions concerning adaptation of a race to temperature, light, altitude, resistance to disease, etc. For example:

HOT - Watusis are tall and thin (to dissipate heat).
They have kinky hair which they keep short to
reduce sweat (prevent dehydration).

COLD - Eskimos are short and fat and have slanted eyes
(protect against sun glare from ice).

5. Students may discuss or write a report on "Adaptability of Human Beings to the Environment of the Future". They may consider the following questions:
 - Is man still changing and adapting?
 - How is man interfering with the natural selection process?
 - How does modern health science affect the gene pool? For example, the number of diabetics in this country is increasing, partly due to the fact that modern techniques (amniocentesis, ultra-sound) make it possible for diabetics to successfully bear children.

Related Activities

Draw a picture of a person from the distant future and label all its physical adaptations to future life.

Examine slides of human skin.

Trace on a map the migration of the American Indian from Asia.

Prepare a display showing ways in which humans breed plants and animals.

Write a paper on the emergence of humankind and emphasize how early man had to adapt to his new way of life (walking erect, etc.).

Research the effects of radiation on the survival of humankind.

Write an essay on the ramifications of human interference with the process of natural selection.

Resources

Collier's World Atlas, R.F. Collier & Son, Corp., 1957, p. 123

People and their Environment Biology, ed. Matthew J. Brennan,
J.G. Ferguson Pub. Co., Chicago, 1972, p. 50 EEC# A14

Wong, Harry K. and M.S. Dolmatz, IIS Biology, Prentice Hall,
Inc., New Jersey, 1976

Steve Gold, contributor

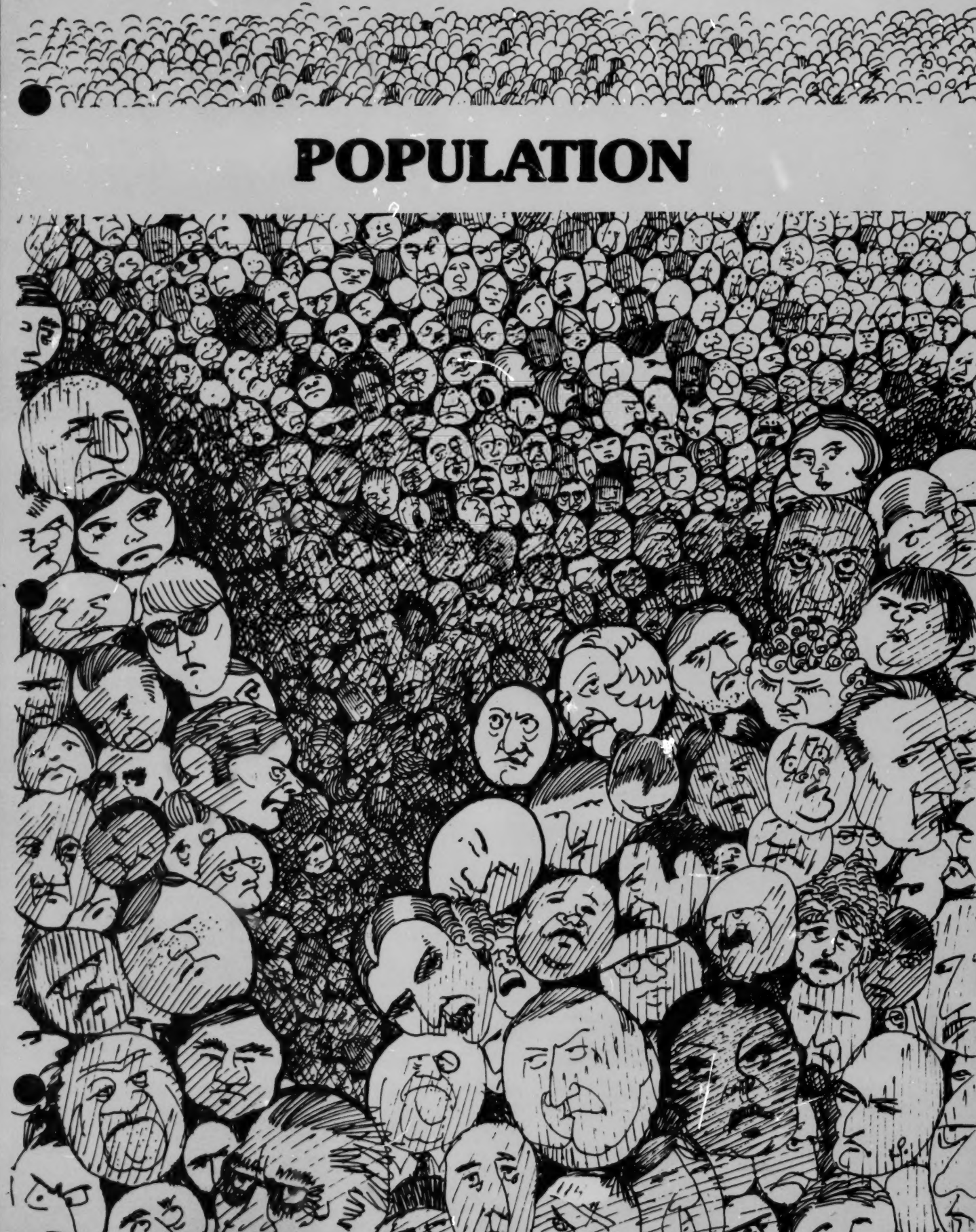
Notes To Myself

STUDENT PAGE

SJNTANS AND RICKETTS

DIRECTIONS: Answer the following questions in complete sentences.

1. According to Darwin's Theory of Natural Selection, what skin color would be best at the Equator?
2. Why would darker skin be of value to a person living near the Equator?
3. Describe two disadvantages which might be experienced by a light-skinned person moving to Brazil.
4. What skin color would be best for an inhabitant of the North Pole region?
5. Why would lighter skin be an advantage to you if you worked at the North Pole?
6. What disadvantages would a dark-skinned person experience were he/she transferred to the North Pole to live?
7. What factors determine which skin color is most suited to a given environment?
8. What evidence do you have that your own skin can protect you in the changing climate of Connecticut?



POPULATION

POPULATION

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POPULATION

"To get land's fruit in quantity
Takes jolts of labor more
Hence food will grow like one, two, three...
While numbers grow like one, two, four..."

--Anon., "A Song of Malthus: A Ballad on Diminishing Returns"

The chorus of voices singing songs of Malthus in recent years has swelled to such numbers that almost all Americans have been convinced that over population is a serious world problem. In our affluent society, however, it is difficult to grasp the full dimensions of world population policy, and many Americans who are absolutely certain the world is overpopulated have only the vaguest understanding of the basic principles of population dynamics. More startling is the fact that most people probably do not realize that the human population is subject to the same principles of growth and control that animal and plant populations are.

Any population is characterized at a particular time by the number of individuals in it. The number of individuals divided by the space occupied by the population gives the population density. Population density is a rough but not exact guide to how "crowded" a population is. For example, the density statistic for New York State indicates how crowded, on the average, New York State is, but it includes in that average the solitude of Adirondack Park and the human hordes of New York City.

Population numbers and population density are, of course, far from constant. Individual organisms are constantly being born, dying, and moving to or away from the area being considered. These "vital statistics" are expressed as rates rather than as simple numbers. For instance, if a population of ten thousand people has three hundred births in the year 1979, its birth rate is thirty per thousand people per year. If in the same year its death rate is sixteen per thousand per year, the intrinsic rate of growth of the population, its birth rate minus its death rate, is fourteen per thousand per year. The actual rate at which the population grows may be different, because the net effect of migration in and out of the population must be considered as well.

The key point to remember about rates of growth is that they are in fact rates. Consider our sample population, and suppose that immigration (movement into a population) and emigration (movement out of a population) just balance each other. At a growth rate of 14 per thousand per year, a population of 1,000 individuals would add 14 new members; a population of two thousand would add 28. The population does not add the same number of individuals each year but a particular fraction of the total--1.4% in this case. A population that maintains such a constant rate of growth will have a characteristic doubling time. For instance, our population growing at 1.4% per year will double, no matter what its original size, in fifty years. This is the essence of geometric growth that Malthus found so alarming--the bigger a population gets the greater the number of individuals each year, even though the rate of growth per thousand stays the same.

Left to their own devices under the best possible conditions, all populations would grow geometrically. In the real world, of course, this does not happen, else all living things would be buried under blankets of whichever species succeeded in maintaining geometric growth. The key is that growth rates do not remain constant; they are instead density-dependent. In nature, as population become more crowded, their birth rate tends to drop as their death rate rises, until eventually an equilibrium population size is reached at which birth and death rates approximately balance each other. The growth rate is then essentially zero. This equilibrium position is the maximum sustainable number for the population, given environmental growth restraints such as predators, competitors, food, and space. It is called carrying capacity.

Did we say that species never sustain continued geometric growth in the real world? That isn't quite accurate. There is one species that has succeeded, through a long period of time, in maintaining almost constant geometric growth. That species, of course, is Homo sapiens.

Has humanity somehow managed to escape the natural limitations which bind all other species? Most ecologists and demographers think not. Instead, humankind has been able to use its intelligence and its technology to constantly push back the limits. The fact that modifications to the natural ecosystem have allowed for the sustenance of more and more people on our planet does not imply that there is no ultimate limit to growth. A simple graph of human numbers against time shows a steady and accelerating growth. But a more careful graph shows population growth taking place in three surges each ending in a period of stabilization and then another surge. Paul Ehrlich links each surge with a particular advance in human society. He calls them the cultural, agricultural, and industrial-medical revolutions. More significant perhaps than the revolutions themselves is the fact that without them human populations would have continued to be more or less stable. The plateaus reached were, in fact, the carrying capacities for the given level of social development. Humanity cannot assume that a fourth revolution of equivalent magnitude will occur and allow it to push past its limits once more. If in fact no such revolution is forthcoming, the built-in momentum of the present population explosion could lead to at least a modest version of the Malthusian nightmare.

Some people believe that the nightmare already haunts our waking hours. When fifteen thousand people in the world die each day from malnutrition, is that not a nightmare despite the fact that birth rates remain high enough to prevent the dramatic population collapse Malthus had predicted? Population scholars point to another salient question regarding human population growth: even if growth can be continued indefinitely, what effect will it have on the quality of the lives lived by our multitudinous progeny? There is no need to belabor the obvious effects of overpopulation--the starvation, the squalid living conditions, the poverty and unemployment which occur when there are too many people and too limited an economic base. It is important, however, to become aware of some of the more subtle manifestations of overpopulation, in developed as well as less-developed countries.

People discuss the energy crisis. Yet if there were fewer people demanding the world's energy the supplies would appear more ample. People complain that the land is being despoiled. But if population were not increasing there would be less need to develop our dwindling supplies of untouched land. Pollution, disease, high prices and wars may not be direct results of population pressure but the role that a too large, too dense or too rapidly expanding population plays in each of those problems is too close to home as more and more people become more and more crowded, dependence upon mammoth and impersonalized systems to supply basic needs inevitably becomes greater. Production to individual specification becomes more and more difficult. Freedom of action becomes increasingly limited as acts which once would influence only the individual performing them have greater and greater influence in other peoples' lives. The end result of overpopulation is a decrease in individuality, freedom, and other humanistic values. If humanity so chooses, it can overwhelm the earth with its numbers. But it will only be an illusory humanness which remains.

-Steve Gold

Who Shall Survive?

Curriculum Topic

CULTURE-SOCIAL CHANGES

Subject

Social Studies

Environmental Topic

POPULATION

Grade Level(s)

6 - 8

Site

Classroom

Skills

Choosing freely, identifying
consequences of alternatives

Author

Ed Lisk

Objective

The student will be able to make the decisions necessary to distribute food that is in short supply.

To The Teacher

Many parts of the world face severe food deficiencies. Only the United States, Australia and Canada are consistent major food exporters, though from time to time other nations such as New Zealand, Ireland, Argentina and Thailand (even India, briefly) have become self-sufficient in grain. Those countries which are not self-sufficient in food production must make up the gap between supply and demand by imports or receiving foreign aid. The mere fact that a nation grows, buys or begs enough food for its people does not mean that hunger is eradicated from that land. People in developing countries are so poor that their income is often measured in terms of amount of food consumed rather than in money terms. Even in the United States some twenty-five to forty million people lack the purchasing power to provide themselves with adequate diets. Worldwide, the grim statistics are so appalling that they fail to reflect the human horror of the situation. Over 460 million people are malnourished; many subsist only on what they themselves can grow. The Food and Agriculture Organization of the United Nations estimates that fifteen thousand people die daily of malnutrition or nutrition-related diseases.

Two thirds of those who die each day because of lack of food are children. Inadequate nutrition (including inadequate maternal nutrition) is a leading cause of the extremely high infant and child mortality rates found in many less developed lands. Even if the child survives, the effects of malnutrition are much more severe on young, developing bodies. Growth is stunted, brains are damaged, and human potential is irrevocably destroyed. In this way the food crisis of the current generation limits the creativity and productivity of future generations.

The malnutrition of children is very often the result of conscious decision-making by parents. Faced with large families and not enough food, heads of families must prioritize. Economic research shows a fairly consistent result. Working males get first dibs at the food. Women are subordinated, often even when pregnant, as their productivity is perceived low. Children sometimes come behind older members of the extended family in the bread line, and are always fed more poorly than adults--they are only eating and not producing anything. Baby girls get the worst deal in the rationing process. Simple family decisions are as important to the nutrition problem as are the major social decisions made by the economic and political systems of food distribution.

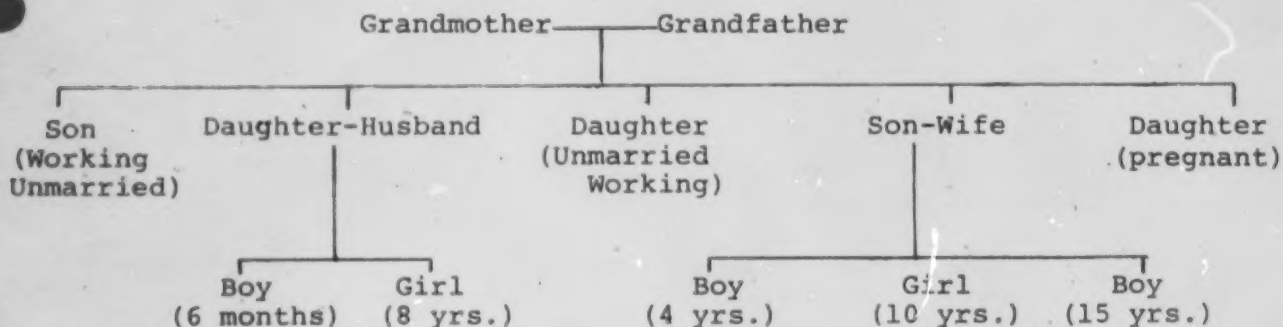
This activity simulates a family with a distinct rationing problem. By participating in this very simple simulation, students will deal with the inevitable result of overpopulation, a shortage of food. The difficulty of and responsibility for making life or death decisions will hopefully encourage students to consider more carefully their own future actions.

Before You Begin

1. Obtain a source of food - artificial or real. (Hint: popcorn works great!)
2. Sixteen bowls for food distribution.
3. An outline or list of the family members involved in the simulation to show to the class.

ACTIVITY

1. The students are assigned (or choose) roles of the following family. (see family tree below) Students not playing a role are observers. Give each role a name and develop a storyline to help each student immerse themselves in their role.
2. Form a circle with desks or chairs.
3. Place the 16 bowls and the food source in the center of the circle. The number of bowls of food each member receives will determine the quality of survival. The following amounts of food reflect health status: 0 - $\frac{1}{2}$ bowl imminent death, $\frac{1}{2}$ - 1 bowl malnutrition, 1- $1\frac{1}{2}$ bowl adequate health, $1\frac{1}{2}$ -2 bowls luxury living.
4. Let the group discuss and then make a final distribution decision after 15-20 minutes. Then allow the rest of the period for discussion of the groups' decisions. The discussion could include an analysis of the group's consideration of the following variables:
 - A. Age of family members.
 - B. Number of survivors from each immediate family.
 - C. Ability to work.
 - D. Contribution to family welfare.
 - E. Social prestige and social function.



FAMILY TREE

Related Activities

1. Study the "Green Revolution" - genetic improvements in food production.
2. Explore food problems in Southeast Asia, Africa or South America.
3. Look at the menu in underdeveloped countries.
4. Examine foreign aid programs of the U.S.A.

Resources

Brown, Lester, By Bread Alone, Praeger, 1974.

Hall, M. d. "Your Food", Cooperative Extension Service, Ohio State University, 1976, EEC #1486.

Turk, J., J. Wittes, and R. Wittes, Ecosystems, Energy, Population W. B. Saunders Company, Philadelphia, PA, 1975.

Credit

Steve Gold, contributing editor

Notes To Myself

Your Migration — Past, Present, Future

Curriculum Topic

SOCIAL CHANGE

Subject

Social Studies

Environmental Topic

POPULATION

Grade Level(s)

7 - 8

Site

Classroom

Skills

Organizing information
Collecting and compiling data
Predicting
Recognizing problems

Author

Pat Perrella

Objective

Students will be able to:

1. describe their own migratory pattern
2. predict their future mobility
3. recognize environmental problems that would arise from a sudden large shift in population distribution.

To The Teacher

Each year, nearly 40 million Americans change homes. We are a geographically mobile society. Migration represents a personal adjustment to changing life circumstances and opportunities. For most people, migration has led to a better life. Immobility of people often reflects their isolation from opportunities in the mainstream of society.

The general pattern of migration in the U.S. is to the cities. This has been described as a massive metropolitanization - a steady stream of people from farm and rural areas to cities. Seventy-three percent of the population is already living in urban areas (cities plus their suburbs). But some of the large cities have stopped growing in population and clearly the trend is now toward a move to the suburbs. Some of the reasons for the suburban growth in the past decade are increased availability of loans, the construction of more and more highways, and the desire of city-dwellers to escape the problems of the inner city.

The environmental effects of placing a disproportionate number of people in one area are colossal. Where will the energy come from? Will there be enough food and at what cost? How much pollution can the environment absorb? Will there be enough land for homes? for recreation? The social and psychological effects can be just as devastating.

These are some of the problems that students are asked to think about in this activity. If any students find their own migration information too personal, they should be given the option of not participating in this activity.

Before You Begin

Students will need copies of the Personal Migration sheet. If necessary, students may complete sheets at home.

Words To Know

migration, environment



CONSERVATION NEWS

ACTIVITY

1. Distribute Personal Migration Sheet to each student.
2. Lead discussion and include the following questions:
 - a) During the middle 1800's, Americans moved west in large numbers. What do you think were some of their reasons for moving? Why do families move today?
 - b) What physical and emotional adjustments do you have to make when you move? Consider your basic needs (food, health, schooling, employment, housing), as well as recreation and companionship.
 - c) Do you think many Americans move? Have Americans always been a mobile people? Why or why not?
 - d) Many people moving into one area can have a large effect on the environment of that area. Suppose 2,000 people moved into your town as the result of increased job openings at a new factory. What environmental problems would arise from such a sudden shift in population distribution?
 - e) If you were to move tomorrow, list all of the resources necessary to make that move. How has an increase in mobility in the U.S.A. contributed to the energy crisis?
3. Invite a senior citizen who has long resided in your town to speak to your class on changes in the locale over the past few years. Students will prepare questions for the visitor, tape record the visit, and then write a paper on "The Way it Was in..."

Related Activities

See activity "Moving On" by Pat Perella in this notebook dealing with westward migration in the 1850's.

Involve other classes in the Personal Migration Survey. When the survey is completed, graph the results of each question. Group your answers as broadly as possible, e.g., group residences into regional areas, such as Northeast, South, etc.

Credit

"Resource Material Development: Population Dynamics in Eighth Grade American History," Florida State University, Tallahassee, Florida, 1974

Ann-Marie M. Fleming, contributor

STUDENT PAGE

PERSONAL MIGRATION SHEET

DATE OF BIRTH: _____ MONTH _____ DAY _____ YEAR _____ AGE: _____

WHAT GRADE ARE YOU IN? _____

WHERE WAS YOUR MOTHER BORN? _____
CITY STATE

WHERE WAS YOUR FATHER BORN? _____
CITY STATE

WHERE WAS YOUR BEST FRIEND BORN? _____
CITY STATE

In the following spaces, write down all the different places where you have lived, and how long you lived there.

FIRST RESIDENCE (AT BIRTH)

NUMBER OF YEARS LIVED THERE

CITY STATE

SECOND RESIDENCE

CITY STATE

OTHER RESIDENCES

CITY STATE

CITY STATE

CITY STATE

For the following questions, check the best answer.

1. HOW DO YOU FEEL ABOUT THE MOVING YOU HAVE DONE?

- ☐ COMPLETELY SATISFIED
- ☐ SOMEWHAT SATISFIED
- ☐ SOMEWHAT DISSATISFIED
- ☐ COMPLETELY DISSATISFIED
- ☐ HAVE NOT MOVED

2. IF YOU WERE TO TAKE A FULL-TIME JOB AFTER COMPLETING HIGH SCHOOL, IN WHAT CITY WOULD YOU LIKE TO LIVE?

- ☐ THE SAME TOWN WHERE I NOW LIVE
- ☐ SOMEWHERE ELSE IN THE STATE
- ☐ IN ANOTHER NEW ENGLAND STATE
- ☐ IN ANOTHER REGION OF THE COUNTRY
- ☐ IN ANOTHER COUNTRY

3. WHICH OF THE FOLLOWING DO YOU AGREE WITH MOST?

- ☐ I WOULD LIKE TO LIVE IN THIS STATE FOR THE REST OF MY LIFE.
- ☐ I WOULD LIKE TO LIVE IN THIS STATE, BUT NOT FOR THE REST OF MY LIFE.
- ☐ I WOULD LIKE TO LIVE AWAY FROM THIS STATE AND RETURN HERE LATER IN MY LIFE.
- ☐ I WOULD LIKE TO LIVE IN ANOTHER STATE AND NEVER RETURN TO THIS AREA.

4. HOW WOULD YOU FEEL ABOUT MOVING THIS YEAR?

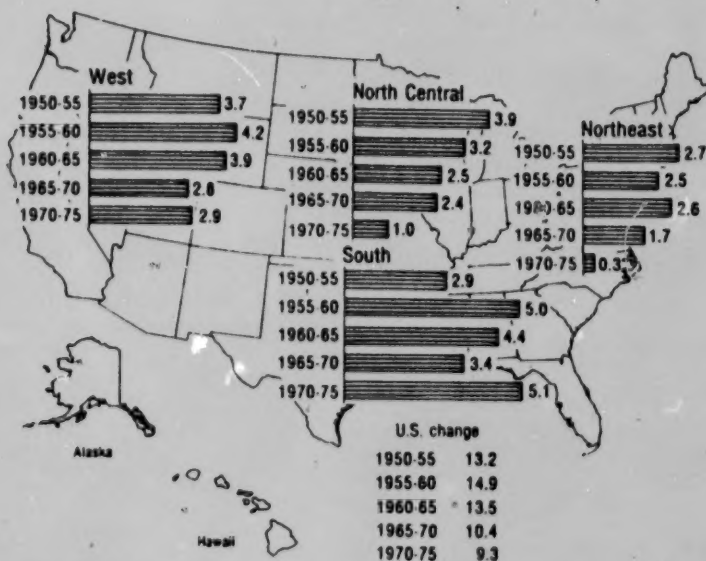
- | | |
|--|----------------------------------|
| ☐ EXCITED AND HAPPY | ☐ UNHAPPY |
| ☐ UNSURE | ☐ WORRIED |

5. WHICH OF THE FOLLOWING PEOPLE HAVE MOVED AWAY FROM YOU?

- | | |
|--|---------------------------------------|
| ☐ MOTHER OR FATHER | ☐ CLOSE FRIEND |
| ☐ BROTHER OR SISTER | ☐ NEIGHBOR |
| ☐ OTHER RELATIVE | |

6. FROM THIS TIME ON, IN HOW MANY DIFFERENT RESIDENCES DO YOU GUESS YOU WILL LIVE DURING YOUR LIFETIME? _____
7. LIST THOSE RELATIVES (OTHER THAN PARENTS, BROTHERS OR SISTERS) WHO LIVE IN THE SAME TOWN WHERE YOU LIVE.
- _____
- _____

Population Change by Region, 1950-75¹



¹Periods beginning July 1, in millions.
Source: U.S. Department of Commerce, Bureau of the Census, *Current Population Reports, Series P-25, No. 640, "Estimates of the Population of States with Components of Change: 1970 to 1975"* (Washington, D.C.: Government Printing Office, 1976), cover 1.

Moving On!

Curriculum Topic

WESTWARD EXPANSION

Subject

Social Studies

Environmental Topic

POPULATION

Grade Level(s)

7-8

Site

Classroom

Skills

Graphing data, interpreting data, communicating information, constructing hypothesis

Author

Pat Perrella

Objective

Students will be able to:

1. describe the typical migrant based on analysis of population data from the year 1850
2. form hypotheses explaining the relationship between population distribution and migration patterns
3. form hypotheses explaining the relationship between the male-female ratio of a country and its birth rate.

To The Teacher

This activity focuses on the people that moved west during the 1850's and the effect migration had on the population composition and distribution. The chart of population distribution from 1840-1860 gives students an opportunity to examine the exact geographic location of the of the U.S. population during that time period. Many social and economic factors affect population composition. Two other factors, sex and age, will be dealt with in this activity.

Mass migration can have important demographic effects. If the exodus from one region to another is too rapid, the result is often economic and physical decay in the old land while the new land suffers over-taxed resources, environmental destruction, and social problems associated with over-population.

Migration has been important in U.S. history. The migration of southern blacks to northern cities, the migration of the white middle class from inner cities to suburbs, and the migration of businesses and their executives from the northeast to the sunbelt have all had profound social effects. During the nineteenth century migration shifted the American population distribution markedly westward. The movement was spearheaded by young males, who were the most mobile and best equipped for the rigors of the "Wild West." This migration had significant impact on the environment, most notably the development of the plains the extermination of the buffalo, the disruption of Indian lifestyles, and improvements in trans-continental transport and communication.

Before You Begin

Make available for each student: 1) a chart on U.S. Population Distribution 1840-1860, 2) 3 graph sheets on age composition of the U.S. population in the Northeast, West, and South

Words To Know

distribution, mobile migration



Courtesy Zero Population Growth/Equilibria

Conservation News 1-15-74 130

ACTIVITY

U.S. POPULATION DISTRIBUTION

1. Discuss meaning of the term "distribution." Hand out dittos.
2. To ensure that students are able to read the table, ask the following questions:
 - a) What per cent of the total population in the U.S. was in the south in 1840? (27.9) west? (29.1) northeast? (42.9)
 - b) What per cent of the total population was in the south in 1860? (25.6) west? (37.8) northeast? (36.5)
 - c) Between 1840 and 1860, which area's share of the population declined the most? (northeast)
 - d) Between 1840 and 1860, which area's share of the population increased the most? (west)

For discussion:

1. Why do you think so many Americans were moving west during this period? (gold, silver, adventure, land)
2. What age and sex were probably dominant in the group that migrated to the west? (young males) Why would they be the most likely to go west?
3. What do you think would be some of the problems facing these westward travelers?
4. Would it be difficult to make a decision to go to a new place? How would you make this decision today?
5. What might happen in the north and south if large numbers of people left those areas to move west?

AGE COMPOSITION

1. Hand out 3 graph sheets on age composition of the U.S. in the northeast, west and south.
2. Direct students to construct a bar graph of age composition for the 3 areas by transferring the population information in the lower left corner to the graph.
3. Put the following sex ratio information on the chalkboard.
 - a) For every 100 females in the northeast, there were 99.4 males.
 - b) For every 100 females in the south, there were 103.1 males.
 - c) For every 100 females in the west there were 241 males.

For class discussion:

1. According to your graphs, which age groups had the largest percentages in each of the 3 areas?
2. Why do you suppose the west had more people in the 20-29 age bracket?
3. Why were so few older people in the west?
4. Why do you think there were so few females in the west?
5. How might this lack of females affect the birth rate in the west? Did it? (check graph)

What could happen in the west to change the birth rate?

Related Activities

See activity "Your Migration, Past, Present, Future" in this notebook.

Credit

"Resource Material Development: Population Dynamics in Eighth Grade American History," Florida State University, 1974.

"A Compendium of the Ninth Census, June 1, 1870," U.S. Bureau of the Census, Washington, D.C., 1872, pp 8-9.

U.S. POPULATION DISTRIBUTION BY REGIONS, 1840-1860*

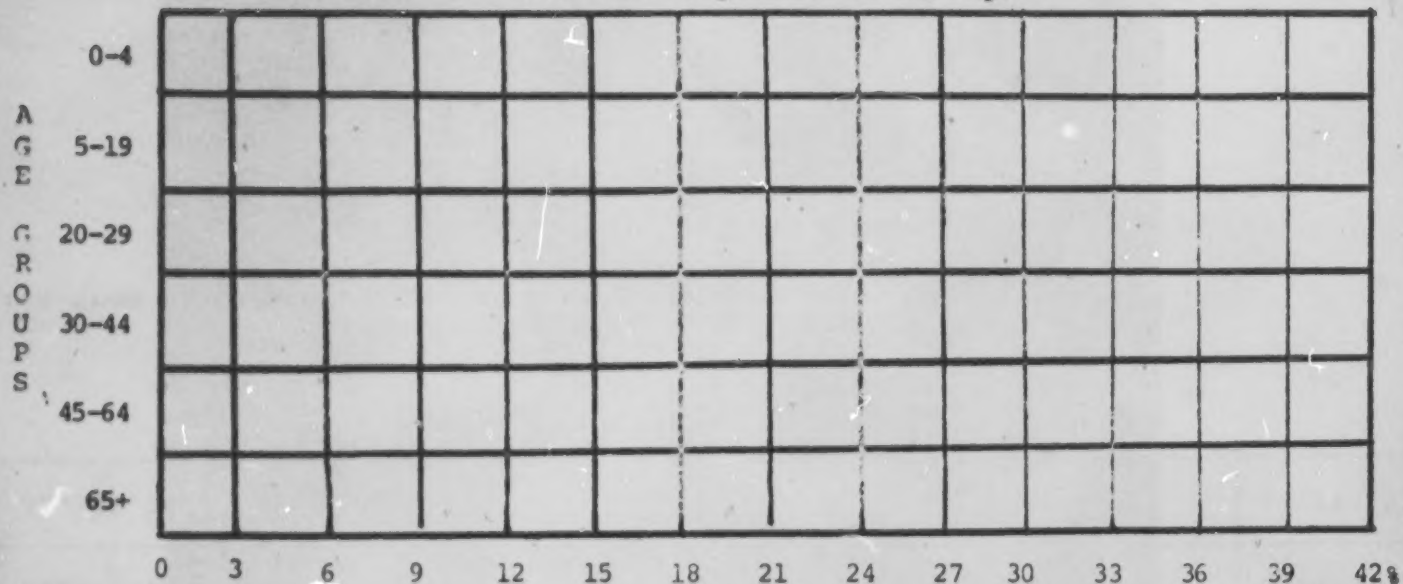
YEAR	TOTAL U.S. POPULATION	SOUTH		WEST		NORTHEAST	
	not including territories	popu- lation	% total population	popu- lation	% total population	popu- lation	% total population
1840	17,019,641	4,749,875	27.9	4,960,580	29.1	7,309,186	42.9
1850	23,067,262	6,271,237	27.2	7,494,608	32.5	9,301,417	40.3
1860	31,183,744	7,993,531	25.6	11,796,680	37.8	11,999,533	36.5

* Statistics from "A Compendium of the Ninth Census, June 1, 1870".

AGE COMPOSITION OF THE U.S. POPULATION - 1850

NORTHEAST

Percent of Population at that Age



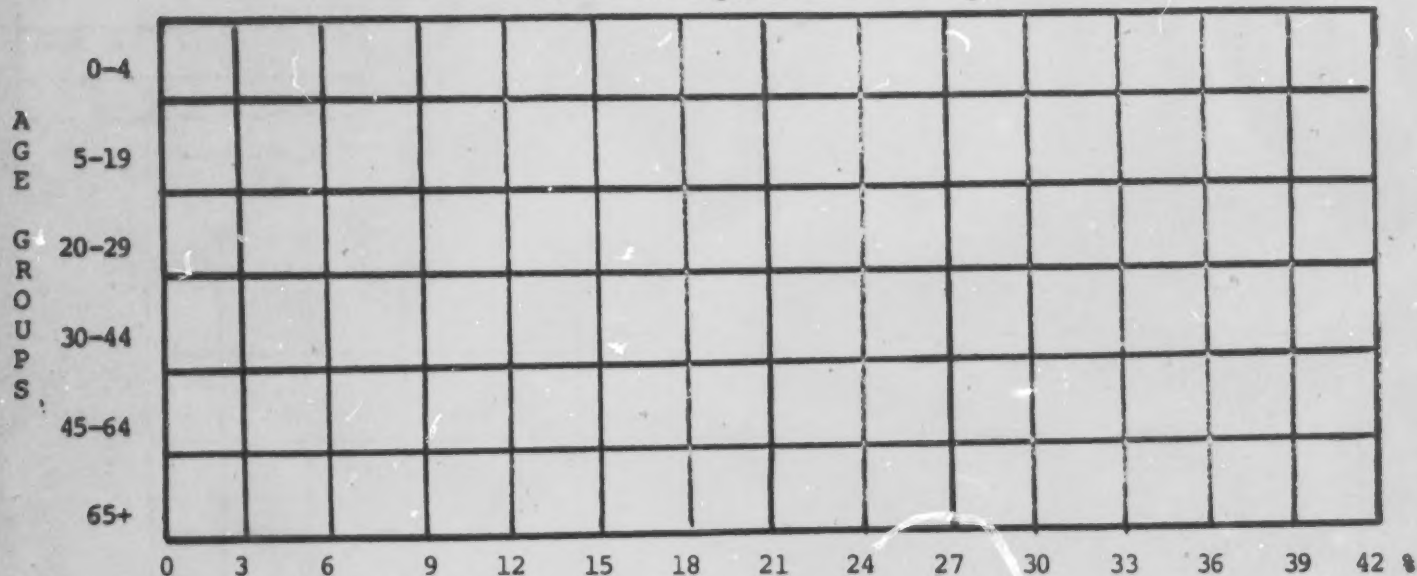
Population Information	
Years	Percentage
0-4	13.2
5-19	34.4
20-29	19.3
30-44	18.1
45-64	11.6
65+	3.4

Adapted from: Donald Boque,
The Population of the
United States, p. 113.

AGE COMPOSITION OF THE U. S. POPULATION - 1850

WEST

Percent of Population at the Age



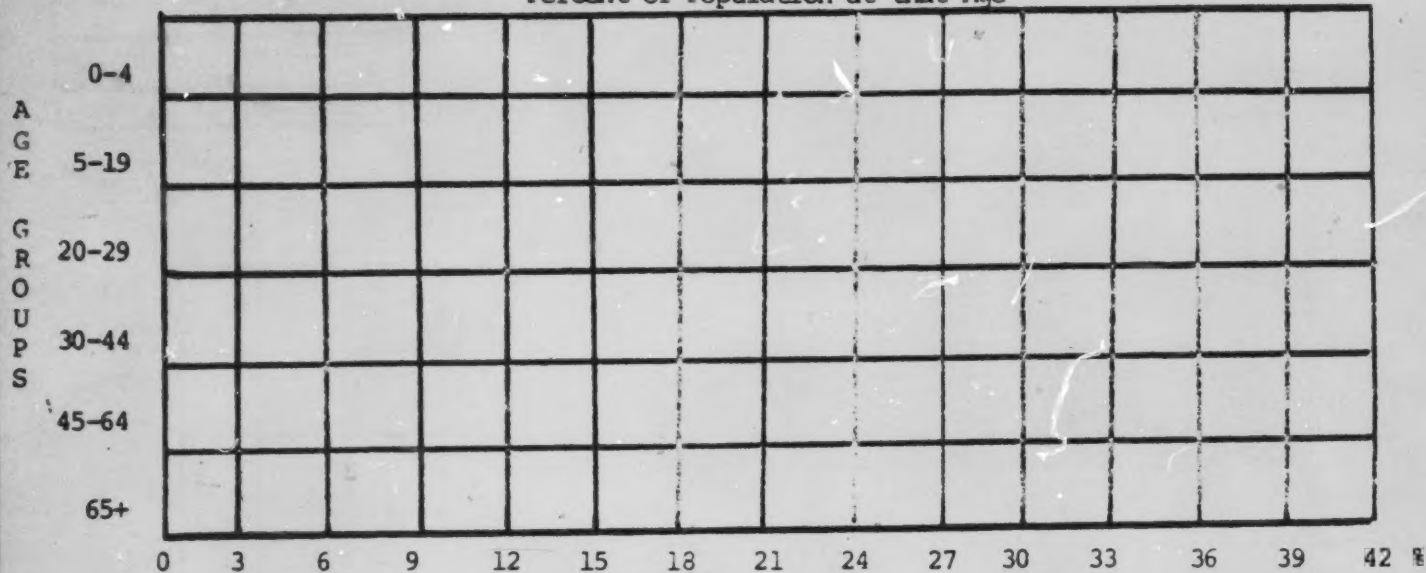
Population Information	
Years	Percentage
0-4	8.4
5-19	23.0
20-29	36.4
30-44	23.4
45-64	7.5
65+	1.2

Adapted from: Donald Bogue,
The Population of the United States, p. 113.

AGE COMPOSITION OF THE U.S. POPULATION - 1850

SOUTH

Percent of Population at that Age



Population Information	
Years	Percentage
0-4	16.3
5-19	39.4
20-29	17.7
30-44	15.4
45-64	8.9
65+	2.4

Why Immigrants Came to America

Curriculum Topic

IMMIGRANTS

Subject

Social Studies

Environmental Topic

POPULATION - PEOPLE

Grade Level(s)

8

Site

Classroom

Skills

Reading information skills,
recognizing problems

Author

Maryann Cronin Horgan

Objective

The student will be able to:

1. list at least five conditions in European countries that were instrumental in leading Europeans to emigrate to the U.S.,
2. identify at least five conditions in the U.S. that were instrumental in leading Europeans to immigrate to the U.S.,
3. form hypothesis explaining the relationship between people's desire to immigrate, and the economic, social, demographic and political variables that existed in their country of origin and the country of their destination.

To The Teacher

In order to understand the reasons behind the large scale European immigration to the U.S., it is necessary to know something about both the conditions which encouraged the Europeans to leave their homelands and the conditions which existed in the U.S. that attracted European immigrants. In this lesson the students will examine materials that describe some of the conditions that encouraged Europeans to immigrate.

After the discussion the students may individually work on the case studies sheet. This exercise will help students to formulate their hypotheses explaining the relationship between migration and the social, economic, demographic and political conditions that would lead people to emigrate from one country, and attract people to immigrate to another.

Before You Begin

duplicate copies of "Skada at America", "Farewell Dear Erin" and three case studies (Poland, Ireland, Russia)

Words To Know

immigrate, emigrate



139

ACTIVITY

1. Distribute copies of "Skada at America" to be read orally. Discuss student's impressions of the song. The following questions would help a discussion regarding the meaning of the song:

- a. Who is singing the song?
- b. How does the singer feel about America? Why?
- c. Does the singer really believe the words of the song?
- d. Do you think that people who heard the song would want to come to America?
- e. Do people think the same today? Explain.

2. The following questions might be useful in discussing the poem:

- a. Who wrote the poem? From which country?
- b. Why did the writer compose the poem?
- c. Where was the Isle of the Saints? How do you think the poet felt about this place? Did he want to leave it?
- d. What is the land of liberty? Why did the poet want to go there?
- e. Was this a big decision for the poet to make? Why or why not? What would you have done in his place?

3. After the discussion of the two poems, have students work individually or complete as homework, the three case studies (Student Page #3). This exercise will help students to formulate hypothesis explaining the relationship between migration and the social, economic, demographic and political conditions that would lead people to emigrate from a country and or immigrate to another country.

4. List the student hypothesis on the board that explains the three case studies. Discuss.

5. Draw two tables on the board as follows:

<u>Emigrate</u>		<u>Immigrate</u>	
<u>Positive</u>	<u>Negative</u>	<u>Positive</u>	<u>Negative</u>

Have the class list under each heading all the reasons a European might consider on deciding to emigrate and all the factors that person might consider when deciding to which country they would immigrate. Discuss results with the class.

Related Activities

1. Interview people in your town of Irish, Polish or Russian descent to discover why they or their ancestors came to America.
2. Research what caused the potatoes in Ireland to die.

Credit

Massialas, B.G., "Changing Populations Through Immigration", Population Dynamics in 8th Grade American History, Florida State University, 1974.

Drawing: Cecelia Zych

Notes To Myself

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SKADA AT AMERICA

Mothers have we far to go
Across the salty water
There we will find America
On the other shore.

CHORUS:

Though you say it cannot be
Take my word and you will see.
It's too bad America
That wonderful America
Should be so far away.

The trees which stand upon the ground
Are all as sweet as sugar
And everywhere you'll look, you'll find
The girls like pretty dolls.

CHORUS:

If you decide you want a wife
Four or five we'll offer
While on the ground and in the fields
English money grows.

CHORUS:

When it rains the poultry falls;
Ducks and chicken pour down;
Geese all fried—prepared to eat;
The fork is in the drumstick.

CHORUS:

Gene Bluestein, "Skada At America,"
on the Folk Box, Elektra Records.

FAREWELL DEAR ERIN

Farewell dear Erin, fare thee well that once
was call'd the Isle of Saints,
For here no longer I can dwell, I'm going
to cross the stormy sea.
For to live here I can't endure, there's
nothing but slavery,
My heart's oppress'd I can find no rest, I
will try the land of liberty.

My father holds five acres of land, it was
not enough to support us all,
Which banished me from my native land, to
old Ireland dear I bid farewell.
My holdings here I can't endure since here
no longer I can stay.
I take my lot and leave this spot
and try the land of liberty.

WHAT DO YOU THINK?

1. Where is the Isle of Saints? The land of liberty?
2. Why did this person write this poem? Where do you suppose the poet lived?
3. What decision has he made? Do you suppose it was an easy decision to make? Why or why not?
4. Have you ever had to make a decision like this one? Was it an easy decision to make?

Poem from: Arnold Schrier. Ireland
and the American Emigration 1850-1900.
(Minneapolis: University of Minnesota
Press, 1958), p. 95.

READ THE FOLLOWING CASE STUDIES AND ANSWER THE QUESTIONS AFTER EACH CASE STUDY.

POLAND

In the late 1800's Poland was ruled by Russia. Many Jews lived in Poland at that time. The Russians did not like the Jews because they kept to themselves. They refused to live like the rest of the Polish people. The Russians put many of the Jews in prison and killed many others. Some of the Jews fled Poland and immigrated to the United States. They sent word back to their friends and relatives that people were free in America. They could worship as they pleased. Many of the Jews packed up their belongings to leave Poland for the United States. They could only take what they could carry themselves.

1. Why didn't the Russians like the Jews?
2. Why did the Jews want to leave Poland?
3. How did the Jews in Poland find out about the United States?

IRELAND

In 1840 most of the people in Ireland were very poor. The only thing they had to eat were potatoes. For several years the potatoes were destroyed by a disease. Many Irish people starved and there was a famine in the country.

The Irish loved their country very much. Being an Irishman was very important to them. Yet they could not get enough to eat. England was already crowded with people so the Irish could not go there to get food. They had heard that there was plenty of food and work in the United States. In a ten year period, one-fourth of the Irish people moved to the United States.

1. What was the main food the Irish ate?
2. Why did the Irish desire to leave their country?
3. Why did they want to go to the United States?

RUSSIA

In 1900 Russia was ruled by a man called the czar. There were many people in the country who did not like the way the czar ruled. These people wanted to overthrow the czar. In order to keep his power, the czar killed many of the people who wanted to overthrow him.

At the same time the Russians were fighting a war with Japan. Although the Russians were expected to win the war, they lost it badly. Many people in Russia were afraid that Russia was losing its power and position in the world. They were also afraid of the fighting between the czar and the people who were against him. Some of these people left Russia to go to the United States where they thought they would be safer.

1. Why did the czar kill so many Russians?
2. Why did so many people leave Russia?
3. Why did so many people go to the United States?

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Problems Found by the Immigrants

Curriculum Topic

IMMIGRATION

Subject

Social Studies

Environmental Topic

POPULATION

Grade Level(s)

8

Site

Classroom

Skills

Using information for a purpose,
developing a plan of action,
identifying alternatives

Author

Maryann Cronin Horgan

Objective

Students will be able to:

1. identify some of the problems faced by different groups of immigrants,
2. predict which groups of immigrants might have had the fewest problems settling in the United States and identify the groups which might have had the most problems settling in the United States,
3. form generalizations about the factors that affect a group of people's abilities to adjust to a new cultural setting.

To The Teacher

The first groups of immigrants to the United States came mostly from Northern and Western European countries of France, Britain, Germany, Scandanavia and Russia. These groups shared many traits in common with early Americans. Consequently, they had a relatively easy time adjusting to the culture of the United States.

In the late 1800's and early 1900's, the patterns of immigration shifted. Most of the immigrants came from Southern and Eastern European countries, including Italy and the Balkans. They were not as well educated as the Northern and Western Europeans. Many of them were fleeing from religious and political persecution so they had little money when they got to their new country. Their customs were different and most Americans resented these newcomers who seemed so foreign. As a result, the Southern and Eastern European immigrants had a difficult time adjusting to their new culture.

In this activity students will read two letters, dated 1870 and 1931, written by immigrants to the United States. Based on their insights of problems immigrants faced, students will participate in a planning effort in order that the next group of immigrants will find it easier to assimilate into the United States.

Before You Begin

1. Duplicate copies of "Letters From Immigrants" (2)
2. Duplicate copies of "Planning a City" for each group

Words To Know

immigrant, potato-caches, political system, ethnic

Notes To Myself

ACTIVITY

1. Have students read the two letters from immigrants and discuss their reactions to it.
2. After the students read the "Letters from Immigrants" the teacher can lead a discussion to help students react:
 - a. Who do you think wrote these letters?
 - b. Why do you think the people who wrote these letters came to the United States?
 - c. What problems did they encounter adjusting to a new country?
 - d. Do you think they were prepared for what they found in the United States? Why or why not?
 - e. Do you think they were happy with what they found? Why or why not?
3. The second part of the activity will enable students, working in small groups, to plan for the future handling of the problems that might arise from an increase in the immigrant population to their city.
4. Have each group take 15 to 20 minutes to finish the worksheet, "Planning a City". The group will select a leader who will report the decisions of the group to the class at the end of the planning period.
5. After each group has reported its decision, the teacher can write each item on the board and help the class to reach a consensus on what can be done to accommodate the next group of immigrants.

Related Activities

1. Investigate different foods that the immigrants brought to America. Make a class cookbook and cook some in class.
2. Visit an ethnic neighborhood and write a report on what you saw and the people with whom you talked.

Credit

Population Dynamics in Eighth Grade American History Episode VII, Changing Populations Through Immigration, B.G. Massialas, Director, Florida State University, Tallahassee, Florida, 1974.

LETTERS FROM IMMIGRANTS

Anonymous

Letter to his Brother and Sister, 1870

After I landed in New York I came to the conclusion that the less one travels in this country the better off one is. It would have been better had I not left New York which is the best place that the Yankees have here. But some people persuaded me that the further west the better it is. I could not believe this but I gave it a try during the winter which was the best time, as I was out of work. I am sending you newspapers from the people selling the land here so that you can judge for yourselves. But beware of catching the American fever when reading them. You can say before starting to read them that every word is untrue. What enticed me to Kansas was to get a little land but by now the amount of land I expect to get is six feet by two feet. The people in the Old Country do not have the vaguest idea what sort of place America is.... Those who have lived here ten years look more like Indians than Welshmen. They have not been able in ten years to save enough money to build a house of any kind. They live in holes in the ground something like the potato-caches that you see in Wales. The sight of them is enough to put anyone off who is thinking of farming in America. The truth is that the land in Kansas is expensive for nothing. Many think that all of the land here is good but that is a great mistake. There is land in almost every state which is not worth having even if you got it for nothing...

...Many would think from the papers in the Old Country that all you have to do is to come to a state and settle there, that the land is to be had for practically nothing, but this is completely wrong. There is plenty of land in every state hardly even touched. You would think that it belonged to no one but try to get a bit of it and you straightaway find that it belongs to a land shark and it is the same all over the country. Thousands of Americans have made their fortunes selling land....Well, you say, what sort of place is America for a poor man or a working man. It is a poor, yes, a very poor place here, especially the farther west you go. One could do better in New York or Pennsylvania if only one could get regular work, which is almost as difficult, if not more so, than in Manchester, due to the weather and the lack of materials. A man can hardly keep himself with one thing and another. He does not work half his time and there are too many workmen here by half and as everything is so dear and work so scarce it is a poor place for a man without money.

Susan Cahill and Michelle Cooper, eds.
The Urban Reader (Englewood Cliffs,
New Jersey: Prentice-Hall, 1971)

I'm in this country four months (from 14 Mai 1931 - Noniton-Antverpen).

I am polish man. I want be american citizen -- and took here first paper in 12 June N 625. But my friends are polish people--I must live with them--I work in the shoes-shop with polish people--I stay all the time with them--at home--in the shop--anywhere.

I want live with american people, but I do not know anybody of american. I go 4 times to teacher and must pay 2\$ weekly. I wanted take board in english house, but could not, for I earn only 5\$ or 6 in a week, and when I pay teacher 2\$, I have only 4\$ - 3\$--and now english board house is too dear for me. Better job to get is very hard for me because I do not speak well english and I cannot understand what they say to me. The teacher teach me--but when I come hone--I must speak polish and in the shop also. In this way I can live in your country many years--like my friends--and never speak--write well english--and never be good american citizen. I know here many persons, they live here 10 or moore years, and they are not citizens, they con't speak well english, they don't know geography and history of this country, they don't know constitution of America.--nothing. I don't like be like them I wanted they help me in english--they could not--because they knew nothing. I want go in the city, free evening schools and lern. I'm looking for help. If somebody could give me another job between american people, help me live with them and lern english--and could tell me the best way how I can fast lern--it would be very, very good for me. Perhaps you have somebody, here he could help me?

If you can help me, I please you.

I wrote this letter by myself and I know no good--but I hope you will understand whate I mean.

Excuse me,
F. N.

Letter of an Anonymous Polish Immigrant to the Massachusetts Commission on Immigration, August, 1941. Report of the Commission on the Problem of Immigration in Massachusetts. (Boston, 1914), 134.

PLANNING A CITY

Pretend that you are the mayor of a large city. Your city has one million (1,000,000) people. In the last five years, 100,000 immigrants have moved to your city. You have reason to believe that many more will be coming in the future. Most of the immigrants do not speak English and cannot read or write.

Many problems have arisen because of the immigrants. You have called a meeting with the city planners to see what can be done about the immigrants. Talk about the problems and try to find solutions for them. You will need to plan for:

Schools
Housing

Jobs
Food

Medical Care
Participation in the Political
System

Develop a plan for your city to handle the problem of the immigrants.

Schools:

Housing:

Jobs:

Food:

Medical Care:

Participation in the Political System:

Other:

Rural to Urban Trends in the U.S. (1790 — Present)

Curriculum Topic

URBAN STUDIES

Subject

Social Studies

Environmental Topic

POPULATION

Grade Level(s)

8

Site

Skills

Graphing data, constructing hypothesis

Classroom

Author

Paul Kubicza

Objective

The student will be able to:

1. Determine the percentages of people who have lived in rural areas and urban areas from 1790 to the present.
2. Form hypotheses to explain why rural areas have declined in population while the urban areas have increased.

To The Teacher

At the time of the first census in the United States in 1790, only 5.1 per cent of the population lived in cities while the large 94.9 per cent lived in rural areas. During each decade since 1790 (except 1810-1820) urban population has grown at a faster rate than the rural. During the decades between 1790 and 1840, the urban population grew more than twice as fast. Between 1860 and 1870, the urban population grew more than four times as fast, and from 1880 to 1930, urbanization proceeded at an even more rapid rate. The first census which showed over 50 per cent of the population living in urban areas was taken in 1920.

Between 1860 and 1900, then, American urban areas were growing twice as fast as the total population. Industrial cities increased, like by-products, with the development of the mine, the factory, the steamship, and the railroad. Once established, however, cities grew by a self-generating process. Social, economic, and political facilities were developed to serve the people: industry, banks, insurance companies, docks and warehouses. These, in turn, attracted more industry and the need for more workers. These jobs often provided more money than farming and, understandably, many farmers left their fields, in many instances, never to return. At the same time, the need for large numbers of farmhands was declining as a result of mechanization, improved seeds, better breeds, care and feed of animals, synthetic fertilizers, and scientific advances in weed and pest-control.

Before You Begin

Prepare class copies of student page (Rural to Urban Percentage Charts). You may also want supplies of two different colored pencils.

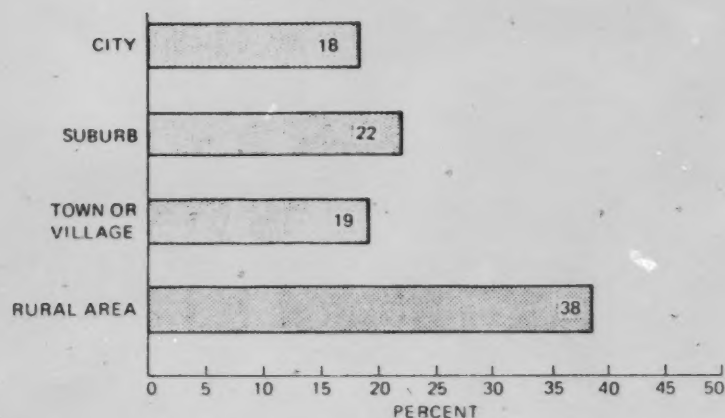
Words To Know

population, rural, urban, census, migration

Factors Influencing Nonmetropolitan Growth

- A large proportion of the American people now expresses a preference for living in a rural area.

PREFERRED PLACE OF RESIDENCE: 1972



Based on a national survey of 1802 individuals conducted by the Gallup Organization in June 1972. Respondents were asked: "If you could live anywhere you wanted to, which one of the kinds of places listed would be your very first choice? In a city, in the suburbs, in a town or village, in a rural area out in the country?" (Three percent responded "Don't know.")

Source: Watts, William, and Free, Lloyd A., Eds., *State of the Nation* (New York: Universe Books, 1973), p. 81.

ACTIVITY

1. Pass out copies of Rural to Urban Percentage Charts.
2. Explain that the left hand columns indicate percentages of people living in urban and rural areas in the given years.
3. Have the students color charts with shadings to show changes in percentages of the population living in urban and rural areas from 1790 to 1970.
4. When students have completed step 3, the following questions may be used for class discussion.

What Did You Learn?

- A. What percentage of the people lived in urban areas in 1790? In 1970?
- B. What year was the first time more Americans lived in urban areas than in rural areas?
- C. There seems to be a steady rate of urban-rural population growth until 1840. What happens after 1840?

What Do You Think?

- A. Why do you think most people lived on farms in 1790?
- B. If urban areas increased, where did the people come from? (Possible answers could include ex-farmers, immigrants, births.)
- C. What are some of the reasons that caused urban growth after 1840?
- D. Why do you think so many people live in urban areas today?
- E. Will the current trend continue? Why? Why not?
- F. Do you think other populations in the world had growth patterns similar to the U.S.?
- G. Where do you plan to live in the future? Why?

Resources

Boughey, Arthur S., Man and the Environment, The MacMillan Company, 1971, p. 161 - 165. The World Almanac and Book of Facts 1978, G. Delury, Newspaper Enterprises Association, 1977, p. 187 - 195.

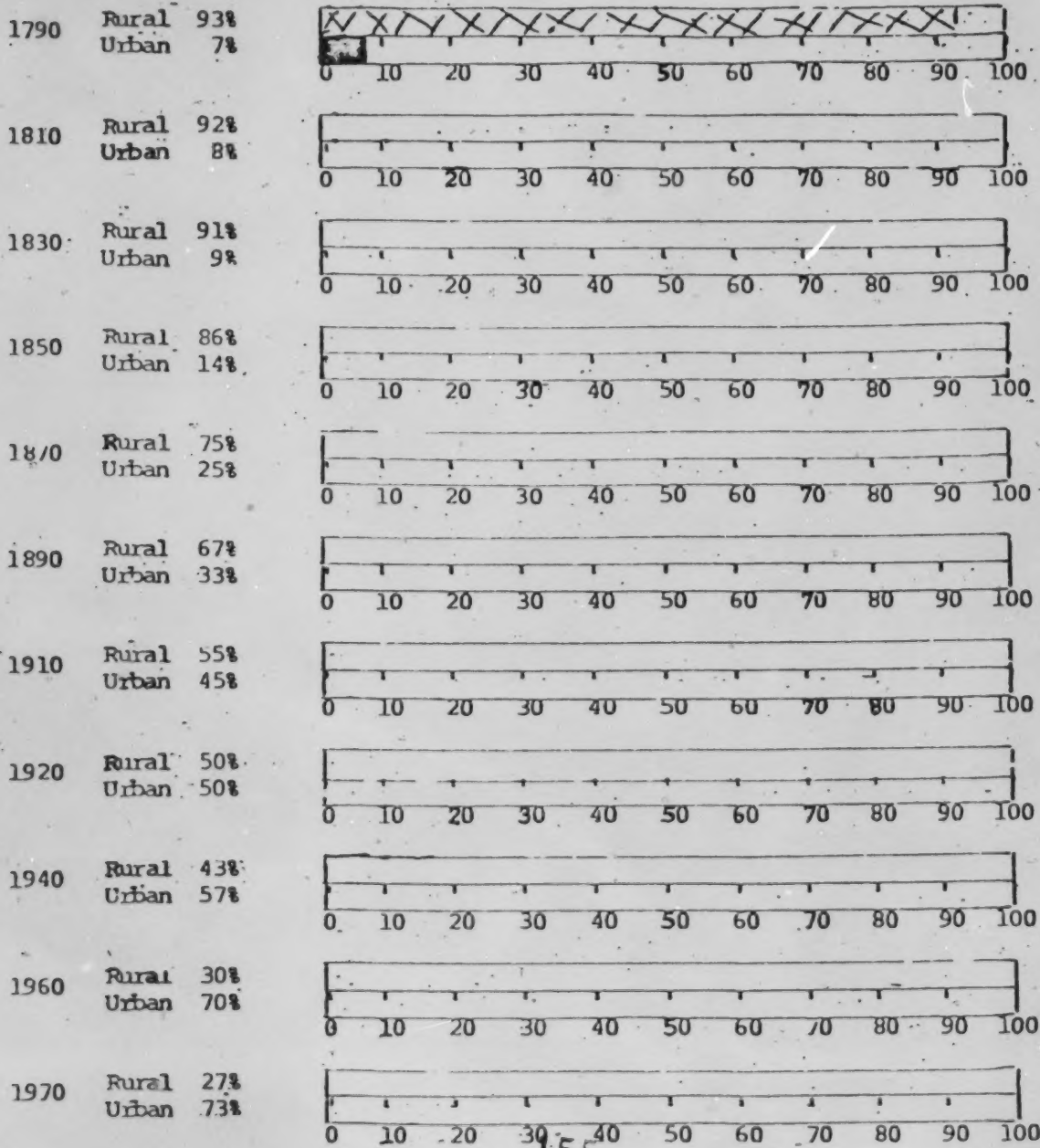
Credit

"Industries, Cities, and People," Resource Material Development: Population Dynamics in Eighth Grade American History, Florida State University, 1974, EEC #148.

STUDENT PAGE

Rural to Urban Percentage Chart

Instructions: In the left hand column, data is given for the percentage of the United States population living in rural or urban areas. Using this data, prepare a bar graph of the percentages of the United States population living in rural and urban areas in each year for which data is given. Use one color for bar representing the percentage of rural population and another color for bar representing percentage of urban population. The bar graph for 1770 has been completed as an example.



Adapted from: U.S. Census Bureau.
Graphic Summary of the United States
Population. Washington, D.C., 1970.

Census of U.S.

Curriculum Topic

AMERICAN CONSTITUTION

Subject

Social Studies

Environmental Topic

POPULATION

Grade Level(s)

7-8

Site

Classroom

Skills

Reading, brainstorming

Author

Paul Kubicza

Objective

The student will be able to:

1. analyze the procedures for preparing and carrying out the first American census.
2. list the intended uses of the first census.
3. develop a plan which possibly would have improved the collection of population data in the first census.

To The Teacher

The size of a population is of importance when analyzing its interaction with its environment. When over-population occurs, necessary factors of life - such as water, food, space, air, or mineral resources may be in short supply. No population, animal or human, can continue to grow without limit because each population has limited access to life supporting elements.

The Constitutional provisions which led to the first census of the United States were created by representatives to the Constitutional Convention. The practical problem of balancing legislative power - gave birth to the census. In forming the new government, the larger states like the populous Virginia, wanted government representation proportionate to their large population. The smaller states, like Delaware, were reluctant to lose the equal voting status which they enjoyed under the Articles of Confederation.

In the end the delegates arrived at the Great Compromise, proposing a Congress with two branches: The Senate, with equal representation, and the House of Representatives, with proportionate representation. To determine the number of representatives for each state a count or census would be made of the people.

The Constitution in Article I, Section 2 required that a census be taken within 3 years of the first meeting of Congress and then once every 10 years thereafter. Free persons and indentured servants would each be counted as one person, whereas Indians would not be counted at all. All other people (slaves) would be counted as three-fifths of a person.

Although the Constitution required a census, it did not determine how a census should be tallied or what information should be collected. Congress had to decide these questions and write a law to implement a census.

The first Census Act (1790) did not require an occupational listing since most men had several seasonal jobs. The census did require that free white males be counted in two groups - those above and those below the age of sixteen - providing information for the military service. The job of counting people was given to United States Marshals and their assistants.

Before You Begin

Preparation: Prepare classroom copies of:

1. Article I, Section 2 of the Constitution
2. Census Act of 1790

Words To Know

census, population, U.S. Constitution, free person, indentured servant, slave

Conservation
News 9-1-73



By permission of ZPG/Equilibrium

'WE DECIDED TO STICK TO THE ZPG.
RECOMMENDATION AND HAVE 1.4
CHILDREN.'

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ACTIVITY

1. Distribute copies of Article I, Section 2 of the Constitution to the class. With the class, analyze this Article emphasizing Congress' role in writing a law to implement the census.
2. Divide the class into groups of five students. Assign to each group the role of legislator in 1790 with the task of writing a law to implement the census. The following questions should be considered:
 - a. How will the census be taken?
 - b. When will the census be taken?
 - c. Who will conduct the census?
 - d. What data should be collected about the population?
3. A representative from each group should report to the class on the law they have proposed.
4. Distribute copies of the "Census Act of 1790". Students may then compare their proposed law with the actual Census Act of 1790. The students should attempt to determine why the two laws differ. The following questions may serve as a guide to discussion:
 - a. What resources were needed to take the census?
 - b. How much information was asked in the census questionnaire? Why were these questions considered to be important?
 - c. Why were fines given to the Marshals if they didn't survey their population?
 - d. Why did the government fine persons over 16 years old who refused to provide census information?
 - e. Why was the census enumerated without a standardized printed form? How might this affect the results?
 - f. How important is a census?
 - g. Should a census be taken using a standardized form?
 - h. If you were a government official, how would you use the results of the census?
 - i. If you were a businessman, how would you use the results of the census?
 - j. How did the census effect taxation of the population?
 - k. Can census data be useful to you as a student? Why?

Related Activities

1. Have students conduct a census in their family or neighborhood. The students should determine what questions they will include in their census.
2. Use the "World Almanac and Book of Facts 1978" to study the population growth of the United States.
3. Investigate how census figures are used today.
4. Obtain a copy of the 1970 census form from the Bureau of Census. Compare it with a 1790 census.

Resources

Stewart, M.S., "Your 1970 Census", Public Affairs Pamphlets, 1969.

"The Nations Census Taker", Bureau of the Census, Washington, DC.

Delury, G., ed. The World Almanac and Book of Facts - 1978, Newspaper

Credit

"Taking a Population Census", Resource Material Development: Population Dynamics in Eight Grade American History, Florida State University, 1974, EEC #151.

Notes To Myself

Census Act of 1790
Approved by Congress March 1, 1790
An Act providing for a census of the population
of the United States (adapted)

Section 1:

The Senate and the House of Representatives of the Congress of the United States declare that this is law. The United States marshal in each district is required to count every person in their state with the exception of Indians who are not taxed. The marshal shall separate free persons, including indentured servants, from all other people in their count. He shall record the sex and the color of all free persons. All free males shall be classified as over or under sixteen years of age.

Each marshal has the power to appoint as many assistants as is necessary to count the population. Each marshal will take the following oath before a judge or a justice of the peace:

I _____ (name), marshal of the district of _____, do solemnly swear that I will cause to be made, a just and perfect counting and description of all persons living in my district, and I will send the count to the President of the United States according to the best of my ability.

The census will begin on August 1, 1790, and shall take nine months to be completed. Each family will be listed according to the names of their family head. Each family will be counted according to the following categories.

Names of heads of families _____
Free white males over 16 years old _____
Free white males under 16 years old _____
Free white females _____
All other free persons _____
All other persons (count as 3/5 of a person)

Section 2:

If an assistant does not count the people in his district and report to the marshal, he will be fined \$200.00

Section 3:

Each marshal shall file his population count with the clerk of his district court. Before September 1, 1791, he shall send a copy of his count to the President of the United States. Every marshal who fails to file the count with the clerk of the district court or the President will be fined \$800.00 for each violation.

Section 4:

The assistants will be paid according to the following scale:

\$1.00 for every 100 persons counted who live in the country
\$1.00 for every 300 persons who live in a city of more than
5,000 inhabitants.

If an assistant feels this is unfair, he can appeal to the marshal and the judges.

The marshals of each district shall be paid according to the following scale:

The marshal of Massachusetts....	\$300.00
The marshal of Maine	200.00
The marshal of New Hampshire ...	200.00
The marshal of Connecticut	200.00
The marshal of New York	300.00
The marshal of New Jersey	200.00
The marshal of Pennsylvania	300.00
The marshal of Delaware	100.00
The marshal of Maryland	300.00
The marshal of Virginia	500.00
The marshal of Kentucky	250.00
The marshal of North Carolina ..	350.00
The marshal of South Carolina ..	300.00
The marshal of Georgia	250.00

Section 5:

Every person will be counted in the district where he is living on August 1, 1790. Even if he moves after this date, he will be counted according to where he was living on August 1, 1790.

Section 6:

Every person over sixteen years old is obligated to answer all questions the assistant asks him. If he refuses to give information, he will be fined \$20.00. The assistant will be given one-half of the fine and the other half will go to the United States Government.

Section 7:

Before each assistant gives his report to the marshal, he shall post two copies in a public place so that the members of the district can see the final count.

Article I. Section 2 of the Constitution of the United States of America

Representatives of Congress and taxes will be divided among all of the states of the Union according to their populations. The population of a state will be counted this way. All free persons shall count as one person. Indentured servants shall count as one person. Indians living on the borders or in the frontier will not be counted at all. All other persons will be counted as three-fifths of a person (including slaves). The population will be counted within three years after Congress meets for the first time. After this the population will be counted every ten years.

Environmental Impact of Burial Customs

Curriculum Topic

GEOGRAPHY

Subject

Social Studies

Environmental Topic

POPULATION

Grade Level(s)

7 - 8

Skills

Locating and obtaining information
Analyzing information
Reading maps
Graphing data

Site

local cemetery
classroom

Author

Ann-Marie M. Fleming

Objective

The students will be able to:

1. examine death as a factor in city planning,
2. become familiar with a map of their locale and zoning laws for disposal of the dead,
3. do research at city departments which deal with disposal of the dead (Office of Vital Statistics, Health Department, Town Clerk),
4. collect and graph information from grave markers,
5. make generalizations about the environmental impact of birth/death rates in the future based on specific information from the past and present.

To The Teacher

A 1971 publication of the Population Reference Bureau, Inc. states that "the next 25 years will see more than 50 million more Americans (or at least six more New York Cities) added to the population. That projection assumes that the average completed family in the decades to come will drop very close to a level of 2 children - less than it has ever been. Other projections, based on less conservative fertility assumptions, would make the increase even greater - anywhere from 60 million to more than 90 million additional people by 1995."

Further complicating this ever-increasing population problem is the trend toward urbanization in America. "In 1920, 51% of the population lived in urban areas. In 1971 some 73% - more than 80 million people - lived in the 33 metropolitan areas of more than 1 million population" (PRB). The more recent trend toward suburbanization has merely spread the boundaries of urban areas without actually relieving the problems of population density. Increases in average income and mobility have resulted in migrations of the population toward regional pockets in the nation. One of these pockets is the megalopolis known as the Atlantic Region, stretching from Massachusetts to Virginia and including the cities of Boston, New York, Philadelphia, Baltimore and Washington. These cities comprise "five of the fourteen metropolitan areas with populations over 2 million and contains some thirty-five million people." (Weissbound)

In the middle of the Atlantic Region lies Connecticut, a small state which contributes mightily to the population statistics. According to 1974 figures, Connecticut is the fourth most densely populated state in the United States and is growing more rapidly than the other three states with higher density. Whereas the United States as a whole averages only 57.5 people per square mile, there are 623.6 people per square mile in Connecticut. With the combination of an expected rise in birth rates and immigration, these figures can also be expected to increase.

The repercussions of overpopulation extend to many environmental areas - mental and physical welfare, land use, energy consumption, pollution, endangered wildlife and increased premature death rate. This activity deals with the environmental impact on the land caused by the imbalance between birth and death rates.

In many instances, when the growth of the population is unchecked by family-planning, nature steps in to limit population growth. "No population can continue to grow beyond certain limits; eventually, involuntary self-elimination - in the form of premature deaths from starvation, pestilence, and wars - will prevent any further increase in density." (Howard)

We are all familiar with the drastic problem of imbalance between birth and death rates in third world countries, where overpopulation has led to disease and malnutrition among millions. Crowding is a fact of life there. But, the problem is, in fact, at hand. All space being finite, how will we cope with the increasing need for land to bury the dead? Even in death, there is no rest from the problems of overcrowding which plague us in life.

Though not always an environmental problem, burial of the dead has always been an environmental factor. Burial customs among communities are varied, but they share one element in common - alteration of the land to meet the religious, social and economic standards reflected in the grave rites.

Not yet socially advanced to stage burial ceremonies, primitive people nevertheless sought to guard themselves from the mysterious fate of their deceased companions. This they accomplished by hiding the dead in the cracks and crannies of caves.

The ancient Gauls and Britons also chose expediency: "Bottle-shaped shafts were cut in the chalk downs and everything that was not required was shot down the aperture, till the receptacle was full, when a tree was planted on the top, and another hole opened up in like manner. These shafts were used as common graves for slaves," as well as receptacles for all manner of refuse. (Puckle)

The more complex a civilization and the more sophisticated its religious tenets concerning death, the more sumptuous were the funerals and greater was the environmental impact on the land. This was especially true when earth burial became a general practice. Burial plots were located on a site on the outskirts of the village (increasing the man-made boundaries of the area). The burial site was considered, even by pagans, as sacred ground and near it was erected a temple. In modern times the church grounds are similarly used as cemetery sites.

In the ancient lands of Mesopotamia and Egypt, burial grounds of a massive scale have been excavated. These include a mass burial uncovered in the ancient Sumerian city of Ur, and the great Egyptian tombs of the Fourth Dynasty. In the first four centuries of the Christian era, Roman catacombs were used by the early Christians as secret burial tombs. Wealthier Christians held title to burial plots which resembled cemeteries of today in landscape and design of memorial chapels. The Christians dealt with the problem of overcrowding in the cemeteries by interring bodies in earthen graves, where as many as ten corpses were laid one above the other, separated by stone slabs.

Burial customs continue to reflect the complexity of the society in which we live. In the United States, burial has become a multi-million dollar business. The home wake has been replaced by elaborate and expensive funeral parlors providing business-like sedateness for the bereaved family. Cemeteries may be traditional plots on church land or apartment-like mausoleums. In many cases, burial is not forever. Burial plots are leased for a period of years, after which time the remains must be removed to make room for more recent customers.

A history of civilization has come to us through burial customs. When the passage of time and the toll of weather have destroyed written records, gravesites and tombstones have often been the only evidence of the lifestyles of former generations. Gravestones of the past have provided us with "a record of religious attitudes and their development, economic conditions in- and out-migrations, national makeup of populations, medical history, social upheavals such as war, epidemics and natural disasters." (Outdoor Classroom)

As we live, so shall we die. Death often provides a more dramatic study of life than life itself. In the overpopulated region of Connecticut, the relationship between birth rates and death rates will become a prime land-use concern of city-planners and environmentalists. Just as we must answer the question, "Where will all the people live", we must also answer the question, "Where will all the people be buried?"

Before You Begin

Materials: graph paper, newsprint and crayons for grave rubbings, dittos of local map, data sheets

Permission may be needed to take students to graveyards.

ACTIVITY

1. Assign a group of students the task of calling the zoning board of their town. They will find out what areas of land have been set aside for cemeteries. On a map, they will outline these areas in heavy black lines and indicate by color shading those cemeteries which are 50 years or older. Choose another color to highlight new cemeteries or additions to existing cemeteries.
2. Now categorize these cemeteries according to whether they are public, church-affiliated, veteran (military), historical, other.
3. Teacher will obtain permission from a local cemetery for some on-site student research. Provide a data sheet for each student or group of students. Information from several grave markers can be recorded on each sheet. Divide the cemetery into sections and assign sections by number to teams of two people each. Each team should have many data sheets, which will be labeled with respect to the section and the sequential number of the grave marker investigated in that section. Make notes on the following: predominant nationalities, family sizes, patterns of in- or out-migration, unmarked graves. Students will then make a copy of a tombstone using the grave-rubbing technique. (Cover the tombstone with a piece of soft paper and rub over the paper with a large wax crayon.) (from Outdoor Classroom Guide)
4. Upon returning to the classroom, students and teacher will discuss categories of information for organizing the data: no. of deaths by month of the year, no. of deaths by year, type of marker (granite, limestone, sandstone), age of deaths (what is the average age, the youngest age, oldest age?). Have each group collect and graph the data for one category. Discuss results.
5. Call the Office of Vital Statistics in your town. What was the death rate in 1967? What was the rate of death for 1977? Is there an increase? How does this compare to the birth rate for these two years (this information can also be obtained from the Office of Vital Statistics)?
6. Talk to the caretaker of a local cemetery. (This will involve the students preparing a list of questions to ask over the phone or during a brief interview while at the cemetery for on-site research). Find out what space limitations, if any, the cemetery is experiencing. What is the size of a plot? the cost? How is the cemetery planning to cope with overcrowding? What is the average number of burials each year? How much space will be needed to accomodate corpses for the next ten years? Has the cemetery made any special allowance for deaths on a large scale (due to epidemics, plane or train acciidents, natural disasters, war)?
7. Call a funeral home and find out the various costs of different burials. (The teacher may here like to read Herodotus' account of the economics of burial in ancient Egypt for a lively comparison.)
8. What other options are there for burial besides interment?
9. Obtain a copy of your city Charter. What codes does it establish for disposal of the dead? What health requirements must cemetery planning satisfy?

Words To Know

vital statistics, interment, cremation, cryogenics, embalming

Related Activities

1. What are the effects of war on the balance of birth/death rate in the U.S.A., in particular WWII and the Viet Nam War?
2. Research the topic of cryogenics and its impact on the environment.
3. Research the burial customs of the ancient Sumerians and Egyptians. What have we learned about their civilizations from their gravesites?
4. Research the problem of disposal of the dead in a gravely overpopulated country such as India. This may be studied in comparison with the problems encountered in the overpopulated city of ancient Rome.
5. Research the problem of pet overpopulation. How does it affect the number of abandoned and destroyed pets? How are the corpses of pets disposed of? What health hazards may result from pet overpopulation?
6. Research the history of Grove Street cemetery in New Haven.

Resources

Howard, Walter E., "The Population Crisis is Here Now," Environmental Problems, Wm. C. Brown, 1973, pp. 27-31 EEC# B55

Outdoor Classroom, U.S. Fish and Wildlife Service, Minnesota, 1975, EEC# 1083

Production, Pollution, Population: Issues for a Changing World, Baltimore City Public Schools, 1974

Puckle, Bertram S., Funeral Customs, Their Origin and Development, Singing Tree Press, Michigan, 1968

Tully, R.R., Jr., A Curriculum Activities Guide, Project Kare, Pennsylvania, 1975, pp 75-78, EEC# 607.10

Notes To Myself

Data Sheet

STUDENT PAGE

Cemetery Study

Names

Date _____

[illegible]

A Cemetery Study In Your Town

Curriculum Topic

SOCIAL CHANGE

The cemetery will acquaint students with social and historical changes in their town

Environmental Topic

POPULATION - Changes, births, deaths, growth rates and migration patterns affect individuals, their surroundings and society

Skills

Collecting and compiling data graphing, interpreting data

Subject

Social Studies, Ecology

Grade Level(s)

6-8

Site

Classroom, local cemetery

Author

Maryann Cronin Horgan

Objective

Student will be able to:

1. describe historical and environmental patterns and events in their own town.
2. recognize changes in the mortality rates of their community.

To The Teacher

Cemeteries offer remarkable and varied possibilities for student enlightenment. Social studies classes will find an abundant record of earlier religious attitudes, economic conditions, migration patterns, nationality trends, medical histories, and historical events such as war or epidemic, fires and flood.

It is possible to reconstruct some of this history by collecting and processing information from grave markers. This must be a careful investigation and as any environmental inquiry, must be respectful of the place in which it is being conducted. Here, such respect is important because information is being collected from an environment which is expressive of strong social attitudes.

In locating a cemetery, try to find one in town that is as old as possible but still in use, so that there will be data available from many different time periods. Be sure to secure permission to visit the site. A class of thirty students can easily collect information from 500-600 markers in two to three hours. Divide the cemetery into sections and give exact locations to students from which to gather data. This will insure coverage of the entire cemetery and reduce duplication of data.

The focus of this activity is to examine changes in mortality rates over time. Students may need help in setting up their graphs to indicate these changes. There will be three line graphs placed on one sheet of graph paper: one graph for the average age at death for men, one for women, and one for children. Each will be drawn in a different color. Students should include a key to explain each color used. The horizontal axis will represent 100 year intervals, and the vertical axis will represent numbers of people. The average age at death for the groups within these 100 year periods will be totaled when the class tallies data collected at the cemetery. A suggestion for the classroom analysis would be to have large sheets of oak tag, each labeled with the appropriate 100 year period (ex. 1800-1899) on to which the students write in their gravestone data (name, birth, death, and age at death). One student could then be assigned to find the average age of death for men, women and children.

Encourage students, as they make their collections of data in the cemeteries, to make inferences from the data about the cultural conditions of other periods. The worksheet provided will help them.

Before You Begin

Materials: clip board or notebook to hold data sheets, large poster boards labeled for 100 year periods (ex. 1600-1699), graph paper, colored pencils.

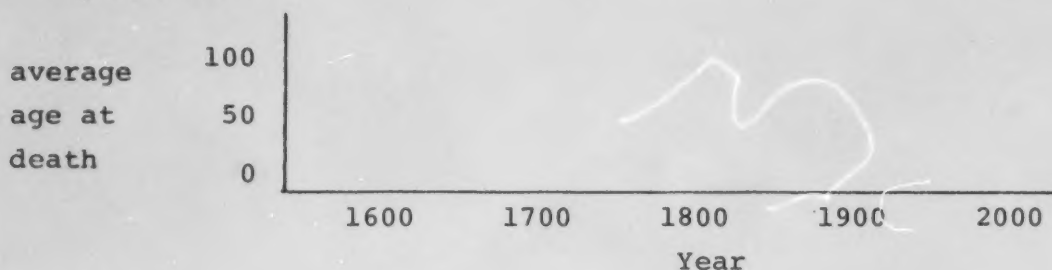
Preparation: Duplicate data collection sheet and Cemetery Project Thought Questions.

Words To Know

population, community, mortality, immigration

ACTIVITY

1. Working in teams of two, students will cover an assigned area of the cemetery to collect data from grave markers. From this data, they can complete the data collection sheet and gather notes for "Cemetery Project Thought Questions" to be completed in class.
2. In class, students will compile data on large poster board, to find the average age at death of the men, women and children during each of the 100 year periods.
3. Students will make a graph to show the changes in average age at death for the men, women, and children of the community. Each line will be a different color and a key should tell what each color represents.



Related Activities

1. Make rubbings of the grave markers for class display.
2. Write an essay in answer to the question: Should large cities open their cemeteries as parks?
3. Study famous people whose names you have found in your cemetery.
4. Compile a list of the occupations discovered from the stones.
5. Collect some of the epitaphs found on the tombstones. Compose epitaphs for famous people

Resources

Environmental Learning Experiences, Ohio Dept. of Education, 1973
EEC #780

Outdoor Classroom, Environmental Education Guide, #7, U.S. Fish
and Wildlife Service, Jenny Publishing Co., Inc., 1975, EEC #1083.

INFORMATION SHEET

1800 - 1899 (19th Century)

1900 - 1973 (20th Century)

FULL NAME	BIRTH	DEATH	AGE	FULL NAME	BIRTH	DEATH	AGE
e.g., John Doe	1834	1881	47	e.g., Rich Smith	1903	1965	62
1.				1.			
2.				2.			
3.				3.			
4.				4.			
5.				5.			
6.				6.			
7.				7.			
8.				8.			
9.				9.			
10.				10.			

Group the ages of the people whose names you recorded:

0-10 _____	51-60 _____
11-20 _____	61-70 _____
21-30 _____	71-80 _____
31-40 _____	81-90 _____
41-50 _____	91-100 _____

During what period did most people die?

19th Century? _____

20th Century? _____

What could be some possible reasons for this difference? _____

STUDENT PAGE

CEMETERY PROJECT THOUGHT QUESTIONS

1. AT WHAT TIMES DID FOREIGN INSCRIPTIONS CEASE? DO THEY CEASE GRADUALLY OR SUDDENLY?
2. WAS THERE A CHANGE IN ORNAMENTATION OR CONTENT OF INSCRIPTION OVER THE YEARS?
3. WHAT NATIONALITIES DO THE NAMES SUGGEST?
4. CAN FAMILY SIZE BE DETERMINED?
5. CAN PATTERNS OF IN- OR OUT- MIGRATION BE DETERMINED?
6. ARE THERE ANY UNMARKED GRAVES? WHAT MIGHT EXPLAIN MANY UNMARKED GRAVES IN CERTAIN LOCATIONS OF THE CEMETERY?
7. IS THERE ANY INDICATION THAT ONE PART OF THE CEMETERY MIGHT BE MORE IMPORTANT THAN ANOTHER?
8. WHAT DOES YOUR DATA INDICATE ABOUT FAMILY SIZE? DOES FAMILY SIZE DECLINE OVER THE YEARS?
9. DO MANY FAMILY NAMES REAPPEAR DECADE AFTER DECADE? DOES THIS BEGIN TO DECLINE? WHEN? WHY?
10. IS THERE EVIDENCE THAT ONE NATIONAL GROUP WAS SOCIALLY DOMINANT? WHAT IS IT? HOW CAN YOU TELL?
11. HOW MANY SOLDIERS ARE BURIED IN THE CEMETERY? IN WHICH WAR DID THEY FIGHT?
12. WHAT EVIDENCE IS THERE THAT HEALTH CARE IMPROVED? ARE THERE ANY OTHER CAUSES FOR CHANGES IN AGE AND CAUSE OF DEATH? IS THERE ANY EVIDENCE OF EPIDEMICS? (EX. INFLUENZA IN EARLY 1900's)

Extra! Extra! People Needed

Curriculum Topic

AUSTRALIA

Subject

Social Studies

Environmental Topic

POPULATION - People
Interaction of human aspirations
and economic opportunities influence
population distribution.

Grade Level(s)

8

Site

Classroom

Skills

Writing
Problem solving

Author

Robert Slie

Objective

The student will be able to:

1. identify ways in which population size can be increased
2. identify incentives which attract people who have skills which are meaningful and useful to a particular geographic area.

To The Teacher

"Australians are much like Americans and Canadians. They speak English and have clothes, food and entertainment similar to those of the United States and Canada. Like the people of the United States and Canada, Australians draw vigor and a sense of purpose from their pioneer past. Australians are an energetic, forward-looking people who are busy developing their industries and their country's various natural resources.

Also like the United States and Canada, Australia has a high standard of living. Most Australians are neither rich nor poor, but belong to the middle class, with enough income to lead comfortable lives. Nearly every family, for example, owns an automobile. Productive farms and ranches provide an abundance of food. Australians have much leisure time to enjoy the many opportunities for recreation that their country offers.

"Australians are largely of British origin. When people moved from Great Britain to Australia, they took many customs with them. For example, Australians drive on the left side of the road, as do British drivers. Tea is the favorite hot drink in Australia, as it is in England. English sports, such as cricket and rugby, are popular in Australia.

"Australia needs many more people to develop fully its industries and natural resources. Economists estimate that the continent can support nearly three times its present population. After World War II, the government began a program to encourage European and people of European descent to move to Australia. Under this program, many immigrants receive some financial assistance from the government, such as free or partly paid transportation to Australia.

"More than 3-1/2 million persons migrated to Australia in the 25 years following World War II. About half of them came from Great Britain. Other large groups arrived from Austria, Germany, Greece, Hungary, Italy, The Netherlands, Poland, and Yugoslavia. About 250,000 of the immigrants were refugees." (World Book Encyclopedia)

In this activity, students will consider ways to influence the population growth of Australia. They will learn that the interaction of human aspiration and economic opportunities influences population distribution.

Before You Begin

1. You may need to review the "want ads" section of a newspaper with the class to familiarize all students with this section's purpose, organization, and content.
2. Make copies of Student Page.

Words To Know

professional, immigrant, emigrant, recruit, incentive, qualifications, skilled, professional, apprentice, tradesman, correspondence, intensive, migrate.

ACTIVITY

1. Ask students to read and then review with them information from the Student Page on Australia's Population Policy.
2. Ask students to construct a Want Ads section of a newspaper: 5 - 10 ads for people of particular skills, offering incentives for these people to leave their own countries for Australia.
3. Discussion questions:
 - a. Whom does the Australian government find to be desirable or necessary immigrants today?
 - b. How large a population can Australia support? What percentage of its present population is this number?
 - c. How effective is advertising in increasing population and filling important occupations?
 - d. In what other ways can Australia hope to increase its population? How effective can these ways be?

Related Activities

1. Ask students to follow the New York Times want ads and keep a scrapbook of advertisements for jobs requiring particular skills, available in Australia.
2. Ask students to write a travel log in which they describe the sights and environmental conditions of Australia which might encourage not only other travellers, but hopefully settlers, as well.
3. Encourage students to construct a collage of pictures from newspapers and magazines in order to illustrate life in Australia.

Resources

- Blunden, Godfrey, The Land and People of Australia, J.B. Lippincott, 1959.
- Brander, Bruce, et. al., Australia, National Geographic Society, 1968.
- Kaula, Edna M., The First Book of Australia, Franklin Watts, Inc., 1960.
- Learmonth, A.M., The Australians: How They Live and Work, Praeger Publ, 1973
- Berry, Leonard, and Richard B. Ford, People, Places and Change: An Introduction to World Cultures, Holt, Rinehart, and Winston, pp 384-399.

Credit

- Student Reading taken from Population Inquiries: U.S. and World Dynamics, Population Education Project, Indiana University, pp 41-42.
- World Book Encyclopedia, Vol. I; Field Enterprises Ed. Corp., 1976, p 872.

STUDENT PAGE

AUSTRALIA'S POPULATION POLICY

While many countries in the world are trying to slow their population growth, Australians are trying to increase theirs. In the face of a growing worldwide demand for skilled professional workers, the Australians have developed a policy of active recruitment to attract skilled people to settle in their country. Each year the Immigration Department decides how many immigrants to recruit according to:

- a. its evaluation of Australia's national needs and objectives;
- b. the availability of suitable immigrants;
- c. the country's capacity to integrate immigrants effectively.

The information with which the Department works comes in part from feedback from the organizations helping to bring new immigrants to the country. Listed below are some of the organizations and policies acting to encourage immigration.

1. Australia has 'migrant offices' in 25 countries. These offices make contacts with potential immigrants in the peoples' own countries. The offices provide information on immigration to Australia and aid the people who choose to immigrate with their planning and move.

2. The Committee on Overseas Professional Qualification is part of the Immigration Department. Its duties include:

- a. working with the 'migrant offices' to match immigrants' qualifications to Australian needs;
- b. It meets with the boards of some professional organizations. The Committee writes descriptive booklets which give background information on Australian professions and explains exactly what qualifications are necessary for the professions;
- c. It works with some Australian businesses to hire skilled people in other countries to come to Australia and take jobs.

3. The Australian government helps to pay the travel costs for some immigrants. This brings immigrants with many different backgrounds to the country.

4. The government provides temporary housing for new arrivals, in centers, hostels, or furnished apartments. All housing is on a short-term basis until the immigrants can arrange more permanent homes for themselves.

5. The government sponsors a variety of services for immigrants after they arrive in Australia. The government aid includes:

- a. help in finding permanent homes;
- b. social workers to help immigrants adjust to life in Australia;
- c. free English language courses for people who don't know English, day and night classes; correspondence school; radio and television classes; and intensive 8-week courses (the latter are offered only in major capitol cities and province centers);

STUDENT PAGE, CONT'D.

d. government-supported projects for teaching English to children.

6. There are special employment standards for immigrants who have training in skilled labor. These standards determine the length of time a person must work as an apprentice before he is eligible to become a registered tradesman or skilled laborer in his field.

a. The full formal apprenticeship training period is four years in Australia.

b. Immigrant tradesmen who have finished three years' formal training in their home country need work only one year in Australia as an apprentice before they are eligible for registration as tradesmen.

Population Growth vs Food Production

Curriculum Topic

ASIA, AFRICA, LATIN AMERICA

Subject

Social studies, math

Environmental Topic

POPULATION - PEOPLE
ENERGY - RESOURCES

Grade Level(s)

8

Site

Classroom

Skills

Map skills, drawing conclusions

Author

Robert Slie

Objective

The student will be able to:

1. define a food calorie,
2. compare our daily caloric intake to that of other areas of the world,
3. identify areas of the world whose populations suffer from calorie deficiency,
4. understand and apply the Malthusian Theory of population growth and food production,
5. become aware of the alternatives to present land use and food consumption.

To The Teacher

The fact that mankind may overpopulate the earth is a very real problem today. The existence of the problem, however, was recognized as long ago as 1798 when the Englishman Thomas Malthus published his Essay on the Principle of Population. Malthus argued that population increases at a greater rate than does the food supply. Many persons, thinking that his idea explained the continuing existence of poverty, used it as an excuse to avoid making reforms designed to aid the poor, as it seemed to explain that poverty was unavoidable. Although improved production techniques weakened Malthus's arguments in the nineteenth century, the problem that he discussed seems once again to be coming to the fore. (from Hanscom, James, et al)

Calorie is a unit used to measure heat energy in the metric system of measurement. A calorie is the amount of energy needed to raise the temperature of one gram of water by one degree Celsius. The word calorie comes from the Latin word calor, which means heat. A kilocalorie, or kilogram calorie, equals 1,000 calories.

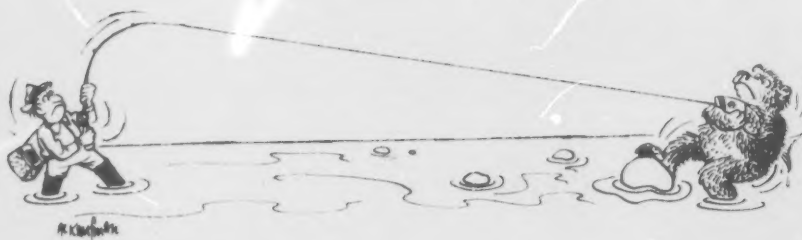
Many chemical reactions (changes) produce heat. Scientists measure the amount of heat produced with an instrument called a calorimeter. One of the most important uses of the calorimeter is to measure the amount of heat given off by different foods when they burn. This measurement tells how much energy a certain food has when it is completely used by the body. Food scientists measure the heat produced in the calorimeter in kilogram calories, but they report the measurements as food calories or simply calories. (from World Book Encyclopedia, p. 58)

The average calorie intake of a person in one country compared to one in another country would help indicate the standard of living of those countries and determine their ability to feed their population.

This activity will increase students' awareness of the problem of population growth and availability of food to support the population increase. Also, students will realize the high standard of living enjoyed by our society and the meager existence of many in other countries.

Before You Begin

The teacher should construct and hand out to students dittos for the special food map and question sheet found at the end of the activity section



Conservation News

ACTIVITY

1. Introduce the students to the Malthusian Theory and predictions of the impending crisis of Population-Food Production. Emphasize the close relationship between population growth and food production. Determine how we can increase food production and make people aware of the needs of these famine areas of the world.

2. Have students read an excerpt from Lalthus' theories such as "Too Many People?" from his Essay on the Principle of Population.

3. Explain to the students what a food calorie is and how and why it is measured.

4. Using a list of food calories provided by the teacher, have the students record their caloric intake over a period of two or three days. Determine the average intake for the class.

5. Research caloric intake for world regions. The information is then placed on an outline map such as the example included.

Starvation - less than 1500 calories/person/day
Potential starvation - 1500 to 1900 calories/person/day
Adequate - 1900 to 2300 calories/person/day
More than adequate - 2300 or more calories/person/day

6. Once students have completed the map, devise a worksheet designed to determine where and to what degree the world suffers from famine (such as the one included)

- A. To what extent has Malthus's prediction come true?
 - B. In what ways can food production be increased?
 - C. In what ways can population growth be controlled.
 - D. What is the most acceptable way to alleviate this dilemma?
- Controlled population? Alternative food supplies?

7. After students have completed their calorie intake chart and the calorie level map of the world, have them compare their level with that of some area of the world.

8. Then have them consider the following questions:

- A. Which area of the world is experiencing the most extensive starvation problems?
- B. In which area of the world is starvation affecting the most people?
- C. The hunger problem, although not confined to one hemisphere, seems to be more severe in which hemisphere?
- D. Those areas experiencing famine seem centered in which latitudes?
- E. Name one continent which seems to have more than adequate calorie intake.
- F. Name one continent where famine seems to exist.
- G. Which of the starvation level areas is affected by its overwhelming population?
- H. Which of the potential starvation level areas is affected by its overwhelming population?

- I. Which of the continents besieged by famine is experiencing these problems because a climatic type seems to be moving further south?
- J. What is that climatic type mentioned above?
- K. Are the areas blessed by "feast" the grain eaters or protein eaters of the world?
- L. Are these same "feast" areas the developed or undeveloped areas of the world?
- M. Which continent seems to have the most serious food problem?
- N. Which country suffers most from floods and typhoons that lay waste to its foodstuffs?
- O. In which category from your "food map" do most of the tropical countries lie?

Related Activities

1. Write to the World Food Council and request information about present efforts and programs for food-short nations.
2. Write to the Department of Agriculture to determine what it is doing to alleviate the world food problem.
3. Write to your Congressman and Senator to discover if they support, or might sponsor, any national food policy which would send surplus food overseas.
4. Write and request information from the United Nations about the present world food situation and how you, your class, your school, your family or your community might be of assistance.
5. Sponsor a food drive and collect non-perishable foods that might be distributed through a church organization or mission to needy communities in the world. (There is a possibility that this project might lead to some type of "sister-city" relationship.)

Credit

Environmental Education Curriculum Infusion Units, General Education and Curricular Services, The University of the State of New York, State Education Department Albany, New York, 12234.

Resources

Callahan, Dorothy, and Alma Smith Payne, The Great Nutrition Puzzle, New York: Charles Scribner and Sons, 1956.

"Feast for the Vulture", Time, November 8, 1974, pp. 40-41.

Hanscom, James et al. Voices of the Past: Readings in Modern History, NY, The MacMillan Company, 1967, p. 57.

Lowenberg, Marion E., Food and Man, New York: John Wiley and Sons, 1974.

Malthus, Thomas, Ed. Gertrude Himmelfarb, On Population, New York The Modern Library, Random House, 1960.

"Running Out of Food", Newsweek, November 11, 1974, pp. 56-68.

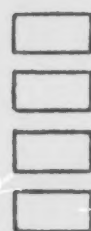
"World Food Crisis", Time, November 11, 1974, pp. 66-83.

World Book Encyclopedia, Field Enterprises, Chicago, 1976, Vol. 3 p. 58.

FEAST OR FAMINE

A SPECIAL WORLD FOOD MAP

by _____



STARVATION

POTENTIAL STARVATION

BELOW ADEQUATE CALORIE INTAKE

ABOVE ADEQUATE CALORIE INTAKE



Population Growth

Curriculum Topic

ECOLOGY

Subject

Science

Environmental Topic

POPULATION - PEOPLE

Grade Level(s)

3 - 7

Site

Classroom

Skills

Model construction
Computing
Predicting
Graphing data

Author

Orah Elron

Objective

The student will be able to:

1. Guess the growth rate of a mouse population.
2. Construct a model to illustrate this growth rate.
3. Figure mathematically how many mice would be born in each generation, and how large the population would be after a half year using only addition and simple multiplication.
4. Construct a graph to show the rate of population growth (for higher grades only).

To The Teacher

Each group of organisms of the same kind living and reproducing in a particular area is called a population. Thus, we speak about the field mice population on "our farm," or the opossum population at the "Fairfield Sanctuary." The number of organisms in one population depends on the birth and death rate in that particular area. A population grows if more organisms are born and raised than die in the same area. Population growth, therefore, is highly dependent on birthrate and living conditions (available food, the natural enemies, the shelter, etc.) in a certain area. In nature, populations are often fairly constant, because under normal conditions, birth and death rates largely balance. In the lab (or under unusual conditions in nature), man can adjust several factors in this balance, and thus keep all the offspring of each pair of mice alive by supplying the necessary large quantities of food and avoiding any infectious diseases from outside the lab. In such a situation the population of mice in the lab will grow at a very fast rate.

Children and many adults will find it difficult to understand that scientists are alarmed about the growth rate of mankind. This activity will illustrate to young students how fast populations grow when the natural death rate is affected by medicine and technology.

Before You Begin

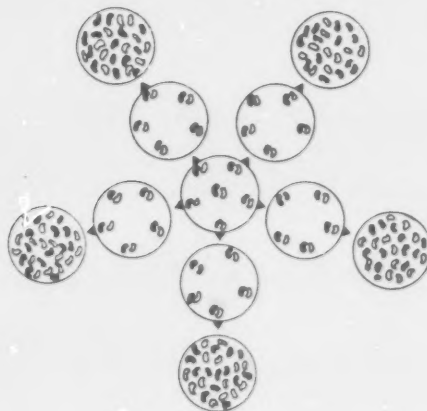
MATERIALS: two large bags of beans (dark and white), glue, several petri dishes or plastic lids for each group of students, pencils, paper, graph paper

Words To Know

population, growth rate, geometrical growth, generation

Related Activities

Try to find the limiting factors in nature which maintain the field mouse population at a balanced growth rate.



THREE-GENERATION MODEL OF MOUSE
POPULATION

ACTIVITY

1. Start this activity by telling a story about a child who received a pair of white mice as a birthday gift, and was very happy when the first litter of 10 pink babies was born. Divide the class into small groups. Introduce the black and white beans as male and female baby mice, and have each small group of students illustrate the above situation by taking one white and one dark bean to represent the parent mice received by the little boy. What happened after several weeks? In another petri dish, glue beans representing the mice of the new litter.
2. The small student groups then guess (estimate) how many mice they would have in two months, in a year if their original pair had a new litter of 10 (5 females, 5 males) every month. The group will collect the estimates of individual members and then arrive at a group estimate.
3. Students then use the beans and lids to illustrate the hypothetical population growth:

A.



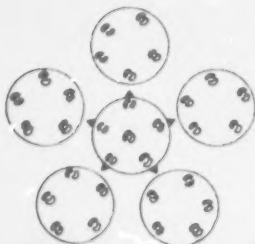
The parents...

B.



give birth to 10 mice.

C.



After 2 months, (one month for maturation, one month to breed and bear young), each new pair of young mice has a litter.

4. If the students are ready for the more advanced math, consider that the original pair of mice has a new litter after the second and third months. In addition, these new generations each bear an additional litter. Beans representing these mice can be added to the model vertically (i.e., stack petri dishes, creating a tower of generations). Have students find a way to arrange the new generations vertically and horizontally. Glue each new generation on a new dish, or make chains of beans. Stop when the model becomes over-crowded.

Caution: After 4 generations, there are already more than 1500 mice!

5. After having built a 3-generation model (with or without the first pair having a new litter each month), the students will compute arithmetically the number of mice at this stage, after 4 months, 5 months, etc.
6. If the students are advanced in math, have them compute how many mice would originate from the one original pair after half a year. Make a graph or table showing the number of newborn mice each month.

Credit

Elron, Orah and Amelia Terkel, "Our Mice and Hamsters," Matal, (Science for Elementary School, Tel Aviv University), 1975

Changes in Causes of Death in U.S.

Curriculum Topic

HEALTH

Subject

Science

Environmental Topic

POPULATION

Grade Level(s)

7,8

Site

Classroom

Skills

Interpreting data,
predicting

Author

Paul Kubicza

Objective

The student will be able to:

1. identify the major causes of death in the U.S. during the past 75 years and
2. analyze the reasons why mortality causes have changed drastically.

To The Teacher

The causes of death in the U.S. have changed a great deal during the past 75 years while the death rate has declined. Three factors are essential to this declining death rate and changed causes of death: improvement in agriculture, improvements in public sanitation, and development of cures for infectious diseases.

Famine and malnutrition have decreased due to improved agricultural methods, such as the use of pesticides, use of disease resistant crop strains, development of modern machinery for mass production, and use of improved fertilizers.

Public health and sanitation have progressed in the past 100 years. It was not until the mid-1850's that cities such as London and New York constructed public sewers. The development of safe public water supplies and sewage disposal has significantly reduced the incidence of infectious diseases.

The development of antibiotic drugs has made the biggest change in causes of death. Penicillin was developed in 1929, sulfa drugs in 1935, and tetracycline in 1948. These drugs are used to treat pneumonia, tuberculosis, and other infectious diseases. The ability to treat these diseases had led to an increased life expectancy of about 30 years (from 46 years in 1900 to 72 years in 1970).

Our changing diet and exercise habits and the deteriorating state of our environment may have much to do with the increased mortality from heart disease, cancer, and cirrhosis of the liver.

Before You Begin

Preparation: The teacher should prepare copies of the "Ten Leading Causes of Death: 1900, 1940, and 1975" charts. One copy per student would be best.

Words To Know

pneumonia, influenza, tuberculosis, stroke, diabetes mellitus, cirrhosis, diphtheria, heart disease, cancer, antibiotic, arteriosclerosis, mortality



Conservation News 11-15-76

ACTIVITY

1. Pass out copies of "Ten Leading Causes of Death, United States: 1900, 1940, 1975".
2. Explain how mortality is expressed. The rates are given in the number of deaths per 100,000 people per year.
3. Discuss the 10 causes of death in 1900. Make sure that everyone knows what the causes of death are. Many students have never heard of tuberculosis or diphtheria.
4. Discuss the 10 causes of death in 1940.
5. Discuss the changes that have taken place from 1900 to 1940. The following questions may be useful:
 - a. What causes of death in 1900 were no longer in the top 10 in 1940?
 - b. Why are they no longer in the top 10?
 - c. What causes of death in 1940 were not in the top 10 in 1900? Why?
6. Discuss the 10 causes of death in 1975.
7. Discuss the changes that have taken place from 1940 to 1975. The following questions may be useful:
 - a. What causes of death in 1940 were no longer in the top 10 in 1975?
 - b. Why are they no longer in the top 10?
 - c. What causes of death in 1975 were not in the top 10 in 1940? Why?
8. Consider with the students the environmental impact of pesticides, modern agricultural machinery, fertilizers, antibiotics, intensified agricultural practices, sewage systems, etc. which have changed the causes of death in the U.S.

Related Activities

1. Predict changes that will take place in the future in death causes.
2. Hypothesize what the leading causes of death would be like in India, Africa, South America or Canada.

Resources

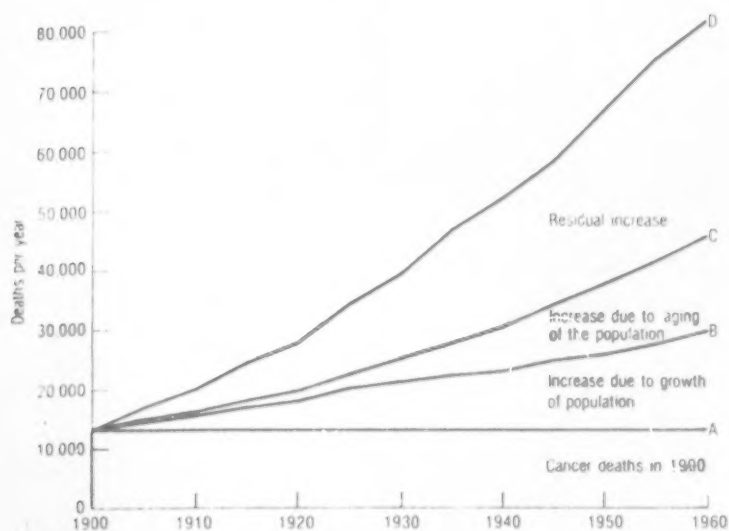
- Bouvier, L.F., and E. S. Lee, "The Health of Americans: Trends in Illness and Mortality", Population Profiles, Center for Information on America, EEC #118.2.
- "Cancer Facts and Figures 1978", American Cancer Society, Inc., New York, New York, 1977.
- "Major Causes of Death in the United States, 1900-1975", Population Reference Bureau, Inc., Washington, DC, EEC #803.5.

STUDENT PAGE

TEN LEADING CAUSES OF DEATH, UNITED STATES: 1900, 1940, 1975 (Rates per 100,000 Population)

1900		1940		1975	
1. Pneumonia and Influenza	210	1. Heart Disease	300	1. Heart Disease	340
2. Tuberculosis	190	2. Cancer	130	2. Cancer	170
3. Diarrhea	140	3. Stroke	100	3. Stroke	90
4. Heart Disease	135	4. Kidney Disease	95	4. All Accidents	50
5. Stroke	110	5. Pneumonia and Influenza	90	5. Pneumonia and Influenza	30
6. Kidney Disease	90	6. Accidents (excludes autos)	50	6. Diabetes Mellitus	17
7. Accidents	75	7. Tuberculosis	45	7. Cirrhosis of the Liver	15
8. Cancer	70	8. Diabetes Mellitus	40	8. Arteriosclerosis	14
9. Infant Disease	50	9. Automobile Accidents	25	9. Suicide	13
10. Diphtheria	40	10. Premature Birth	20	10. Infant Disease	13

Deaths from Cancer, 1900-1960
(for U.S. Death Registration Area of 1900)



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Vegetarian Values

Curriculum Topic

NUTRITION

Subject

Science

Environmental Topic

POPULATION

Grade Level(s)

7 - 8

Site

The home economics classroom

Skills

Group skills, identifying alternatives, identifying feelings about alternatives, recognizing problems, brainstorming

Author

Vicki Parker

Objective

The student will be able to:

1. name 5 sources of protein other than meat products,
2. make a statement concerning meat consumption in the United States and its relationship to the rest of the world,
3. plan and prepare a meatless meal based on previously learned criteria of nutrition, aesthetics, texture and energy conservation,
4. make a value judgement about their personal meat consumption.

To The Teacher

The following material is from the Teacher's Guide of "Critical Issues in Science and Society: A World to Feed" (a sound/slide program from Science and Mankind, Inc.)

The average American consumes two hundred and twelve pounds of meat annually. We like meat. And we've convinced ourselves that all this meat is absolutely essential if we're to get the protein we need for healthy diets. Yet, according to food expert Frances Lappe, we could eat much less meat and fill many of our protein requirements from other sources like milk, eggs, and cheese. Pound for pound, these foods may not contain as much protein as meat, but more of it is usable by our bodies, and these foods are also far less wasteful to produce.

Take a piece of steak, for instance. To produce just one pound of it, a steer consumed twenty pounds of grain.

For a pound of pork, a pig consumed six and three-tenths pounds of grain. But, at least, pork is much less wasteful to produce than beef.

So is poultry. Only three pounds of feed are necessary to produce a one-pound piece of chicken. However, a gallon of milk is even less wasteful, requiring only two and eight-tenths pounds of grain fed to a cow.

And a loaf of bread requires just nine-tenths of a pound of grain. This is because bread, unlike the other foods, is produced directly from grain. And the most efficient method of consuming grains is to eat them directly, as bread, corn on the cob, or wheat germ.

Many experts are now telling us that we must begin to eat more efficiently and give up the wasteful habit of consuming so much meat. But why now? Why should we suddenly begin to change our eating habits when it didn't seem to make much difference how we ate before?

Never before have so many people faced the possibility of famine because they don't get enough grain, which is the major source of protein for their diets. Americans, on the other hand, have enough grain to produce greater quantities of meat than we need to consume.

Harvard nutritionist Jean Mayer estimates that we could release enough grain to feed 60 million people just by eating ten per cent less meat. And if we cut our meat consumption even more, the number of people we could feed would grow much larger.

In addition, B. Tyler Miller Jr.'s textbook Living in the Environment: Concepts, Problems and Alternatives explains in the following diagrams how eating further down on the food chain can be more energy efficient.

Before You Begin

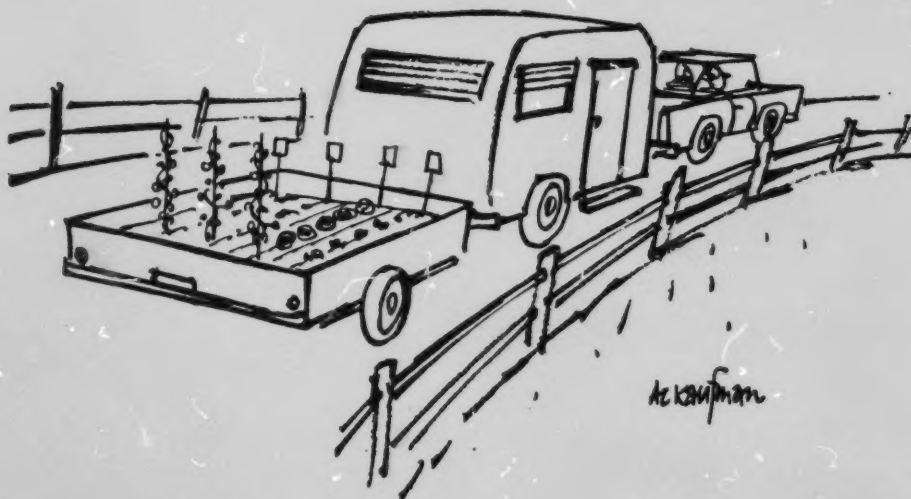
Materials: You will need food necessary to prepare the vegetarian meals. A variety of cookbooks would be helpful during meal planning.

Caution: A caution when using values clarification techniques: In using the values continuum it is important that students not be forced to share their ideas or values. Students may not truly express their beliefs if they feel they will be placed before the class for approval or disapproval. A recommendation for the values continuum would be individual or private continuums followed by group discussion and a classroom continuum composed of volunteer opinions.

Words To Know

vegetarian, food chain, protein, calories, legumes, cholesterol

SEE ACTIVITY ON NEXT PAGE



Conservation News

Resources

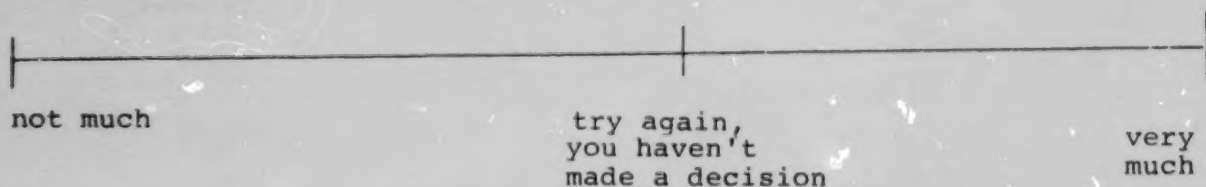
"Critical Issues in Science and Society: A World to Feed" (sound/slide program) Science and Mankind, Inc., White Plains, NY, 1976.

Lappe, Frances M.; Diet for a Small Planet, Ballantine Books, New York, 1971.

Miller, G. Tyler, Jr., Living in the Environment: Concepts, Problems and Alternatives, Wadsworth Publishing Company, Inc. Belmont, CA 1975, pp. 126-127.

ACTIVITY

1. In a lesson on the basic nutrients, brainstorm a list of sources of protein (meat, eggs, cheese, beans, nuts, dairy products, soybeans, tofu...)
2. Through the use of a food pyramid, help students reconstruct the amount of energy (or feed) necessary to raise a beef steer to slaughter.
3. Ask students to rate themselves on a values continuum concerning the question: How much do I value meat in my diet?



4. Ask volunteers to express their opinions on this issue. Make a chart comparing the pro's and con's of meat eating. (expensive, can contribute to high cholesterol, excess use of available resources, quick source of protein, fairly low in calories)
5. Ask students to prepare a week of sample menus that are balanced meals without using meat sources of protein (class may decide whether they will allow fish in the menu.)
6. When all menus are prepared, ask each kitchen in the class to prepare a meatless meal to be shared with the rest of the class.
7. After the meal, ask students to relate their feelings about not eating meat. (your class may already contain several vegetarians). Would anyone refuse to reduce meat intake? Eliminate meat from their diet? What about a diet between the 2 extremes? Introduce the concept that a 10% meat consumption reduction by Americans could feed 60 million starving people. How do students feel about their meat consumption when presented with this idea?

Related Activities

1. Ask volunteers to reduce their meat consumption by at least 10% for one week. Have these students share their feelings with the entire class at the end of this time.

Growth-Graph It!

Curriculum Topic

MATHEMATICS

Subject

Math

Environmental Topic

POPULATION - PEOPLE

Grade Level(s)

7

Site

Classroom

Skills

Graphing

Author

Carla McGeeney

Objective

The students will be able to:

1. plot points on a graph from the information given in a table,
2. distinguish between linear and exponential growth by interpreting a graph.

To The Teacher

Most case studies in population growth use graphs. With one look, the reader can see trends without immediately searching for exact figures.

There are two types of growth patterns: linear (steady growth) and exponential (a snowballing type of growth).

In linear growth a quantity increases by a constant amount in a constant time period. A child who becomes one inch taller each year, for example, is growing linearly.

A quantity exhibits exponential growth when it increases by a constant percentage of the whole in a constant time period. A colony of yeast cells in which each cell divides into two cells every 10 minutes is growing exponentially. For each 10 minutes of a single cell, there will be two cells: an increase of 100 percent. After the next 10 minutes, there will be four, then eight, sixteen, etc. Species' populations' growth is measured exponentially. With the visual presentation of a graph, the students are able to see the trends which have resulted in the much-discussed crisis of overpopulation.

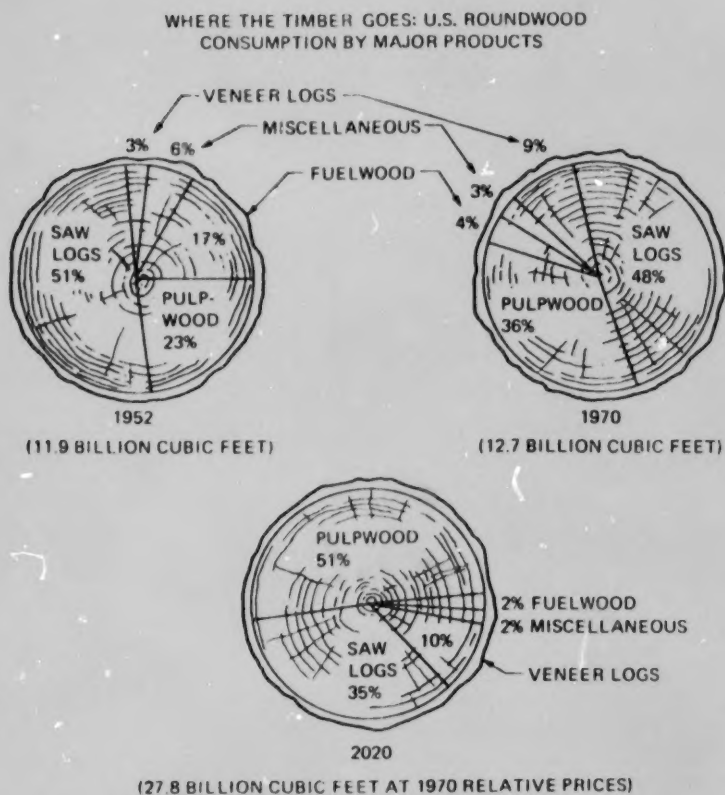
Before You Begin

Materials (for each student): 2 sheets of graph paper for each student, 1 straight-edged ruler

Students should know how to set up a graph by use of axes and appropriate labels.

Words To Know

linear, exponential, table, graph, abiotic, dekaliter



ACTIVITY

1. Instruct students to graph data from their student pages and to answer the questions which follow.
2. Each graph should be labelled as linear or exponential.
3. What are some reasons for exponential growth?
4. Describe the line or curve of each graph type.

Related Activities

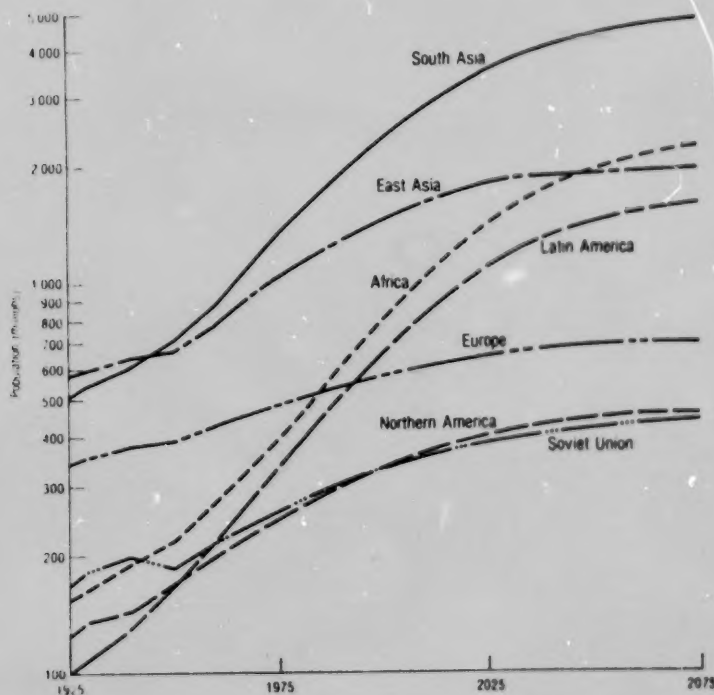
1. Graph some changes in your neighborhood. Cars, new house construction over the past 10 years are some suggestions. Data can be obtained from offices in the town hall.
2. Gather data from an almanac on world population growth. This is one of our most serious environmental problems because of the increasing demands for food, shelter and space which a larger population requires, and the pollution caused in meeting these demands. Graph the data and you will see our concern for the year 2000.

Credit

Sweeney, Robert E., Environmental Concerns: the World; Harcourt Brace Jovanovich, Inc., 1977, EEC #B65A.

Notes To Myself

Population of Major Regions of the World, 1925-2075¹



¹According to the UN medium variant of long range projections (charted on a logarithmic scale)

Source: UN Population Commission, *Preliminary Version of Concise Report on the World Population Situation*, E/CN.9/1974/CRP.1 (14 February 1974), Figure 2, p. 30.

STUDENT PAGE

Read the following paragraphs:

1. In 1940 it was estimated that the United States used 100 million megawatt hours of electrical power. The data shown is accurate up to 1970. Data to the year 2000 is the projected increase. The line drawn on the graph for the projected electrical use from 1970 to 2000 should be a broken line to distinguish it from the actual data which will be depicted by a solid line.

Place the following energy-use data on a graph.

Use of Electric Power

Electric Power (millions of megawatt hrs.)	Time (year)
100	1940
250	1945
400	1950
600	1958
900	1961
1100	1969
1500	1972
2000	1980
2700	1985
5500	2000

Electric power is graphed on the y-axis. Time is placed on the x-axis

Loss of Water in a Lake

2. A large lake in the western United States had 400,000 dekaliters (1 dekaliter = 10 liters)* of water in 1900. Since that time, the lake, like many of our lakes, has been losing water through evaporation and other natural processes. The loss of fresh water is of great concern to environmentalists today.

Prepare a graph of the remaining water volume (y-axis) vs. year (x-axis).

Remaining Water Volume (thousands of dekaliters)	Year
400	1900
200	1910
100	1920
50	1930
25	1940
10	1950
2	1960
1	1970

198

*about 1 million gallons

STUDENT PAGE

Tree Growth

3. If the abiotic (non-living) conditions for tree growth remain constant, a tree will grow approximately the same amount each year. In other words, if rain is normal and there are no harsh storms, growth will be constant.

Graph the growth of this tree:

Height of Tree (meters)	Time (years)
2	1
4	2
6	3
8	4
10	5
12	6
14	7
16	8
18	9
20	10

Population Growth

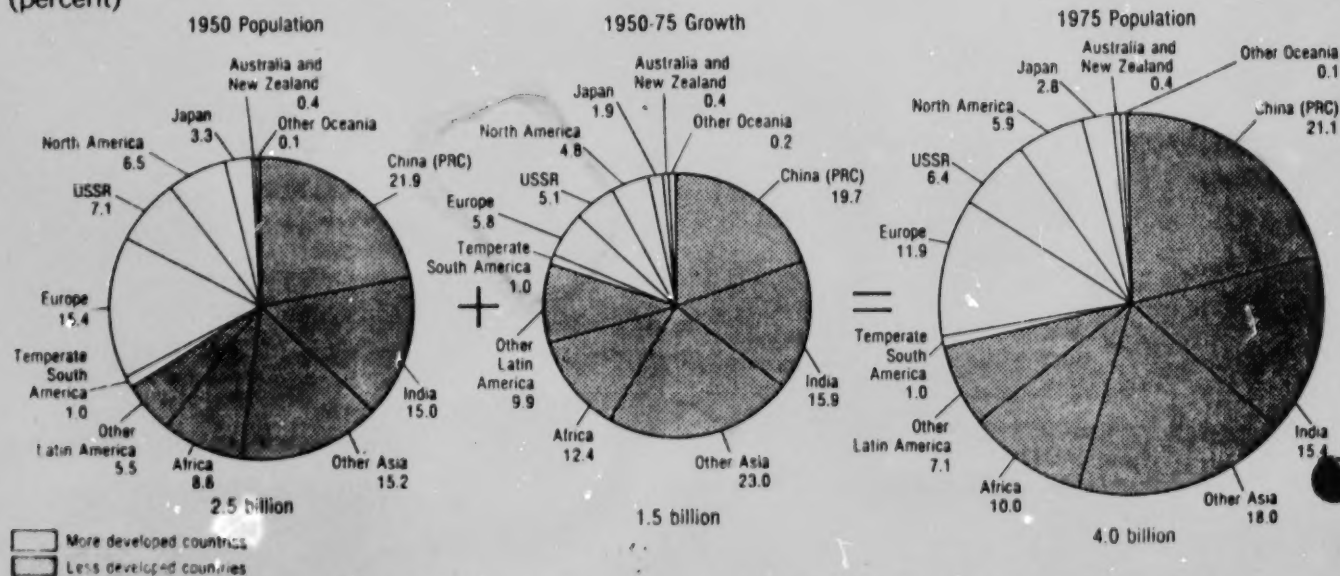
4. The following table shows the growth of population in country X over a period of 600 years. Graph the population growth of country X.

Time (number of years)	Population (millions of people)
0	.25
50	.50
100	1.0
150	2
200	4
250	8
300	16
350	32
400	64
450	128
500	256
550	512
600	1,024

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Five million people can live comfortably in country X before overcrowded conditions arise. From the data on your chart you can see that for 500 years the country can tolerate exponential growth, but 50 years after that the population will double to and reach the limit of numbers for whom that country can provide. The next 50 years will result in a severe crisis. Today pollution, population, use of natural resources and development of industry are all growing exponentially.

World Population Growth, 1950-75
(percent)



Source: U.S. Department of Commerce, Bureau of the Census, World Population: 1975 (Washington D.C.: Government Printing Office, 1976), p. 11.

RESOURCES—ENERGY

"A material or energy form becomes a resource or continues as a resource because a technological innovation makes it available at a reasonable economic and/or environmental cost. The definition of a resource and the concept of an available, usable supply of a resource are therefore closely tied with changing technological capability and economics.

Resources can be separated into two categories:

- Non-renewable:** a finite quantity of reserves that are made available to society as a function of available technology and capital investment. The depletion of non-renewable resources is dependent on the status of supply and demand for their use.
- Renewable:** infinite reserves are available at specific rates to humanity depending upon specific locale; their availability as an energy resource is also a function of available technology and capital investment. The depletion of renewable resources, then, is dependent on the rate at which they are used.

Important distinctions between these two types of resources are summarized below:

NON-RENEWABLE RESOURCES	RENEWABLE RESOURCES
-exist in the earth in limited quantities that could conceivably be used up	-will be available so long as the earth ecosystem continues to function
-comprise forms of high quality energy that have been historically easier to collect and use	-tend to be of higher entropy and require more effort and energy input for collection and use
-constraints on availability arise from the necessary energy required to pump or dig them up	-available for use as fast as they are supplied by the natural system—for example, more wind or sunlight cannot be collected than passes through an area during a day

These distinctions provide a way to separate energy resources into renewable and non-renewable categories. This separation is exemplified in the following chart:

NON-RENEWABLE PRIMARY ENERGY RESOURCES	RENEWABLE PRIMARY ENERGY RESOURCES	
Petroleum	Solar	Radiant Solar Heat Photovoltaic Conversion
Natural Gas	Hydrological	Fresh Water Hydroelectric
Coal	Oceanographic	Tidal Temperature Gradient

Fissionable
Materials

Geothermal

Steam
Heat

Wind

Life Forms

Human
Photosynthesis
Forests

Recyclable
Waste

It is important to realize that the depletion of non-renewable resources is dependent on the quality and quantity of demands for which they are allocated, as well as their supply or rates of availability. Goods and services are the visible results of a resources delivery system, which is one way to describe the series of processes needed to change a raw resource into useful work or end use. Questions of allocation, however, also bring up the social aspects of equitable distribution of and access to both primary resources and the goods and services produced from them. These types of consideration make it necessary to examine the entire resource system in order to maintain a holistic mode of inquiry in an environmental education situation.

ENERGY

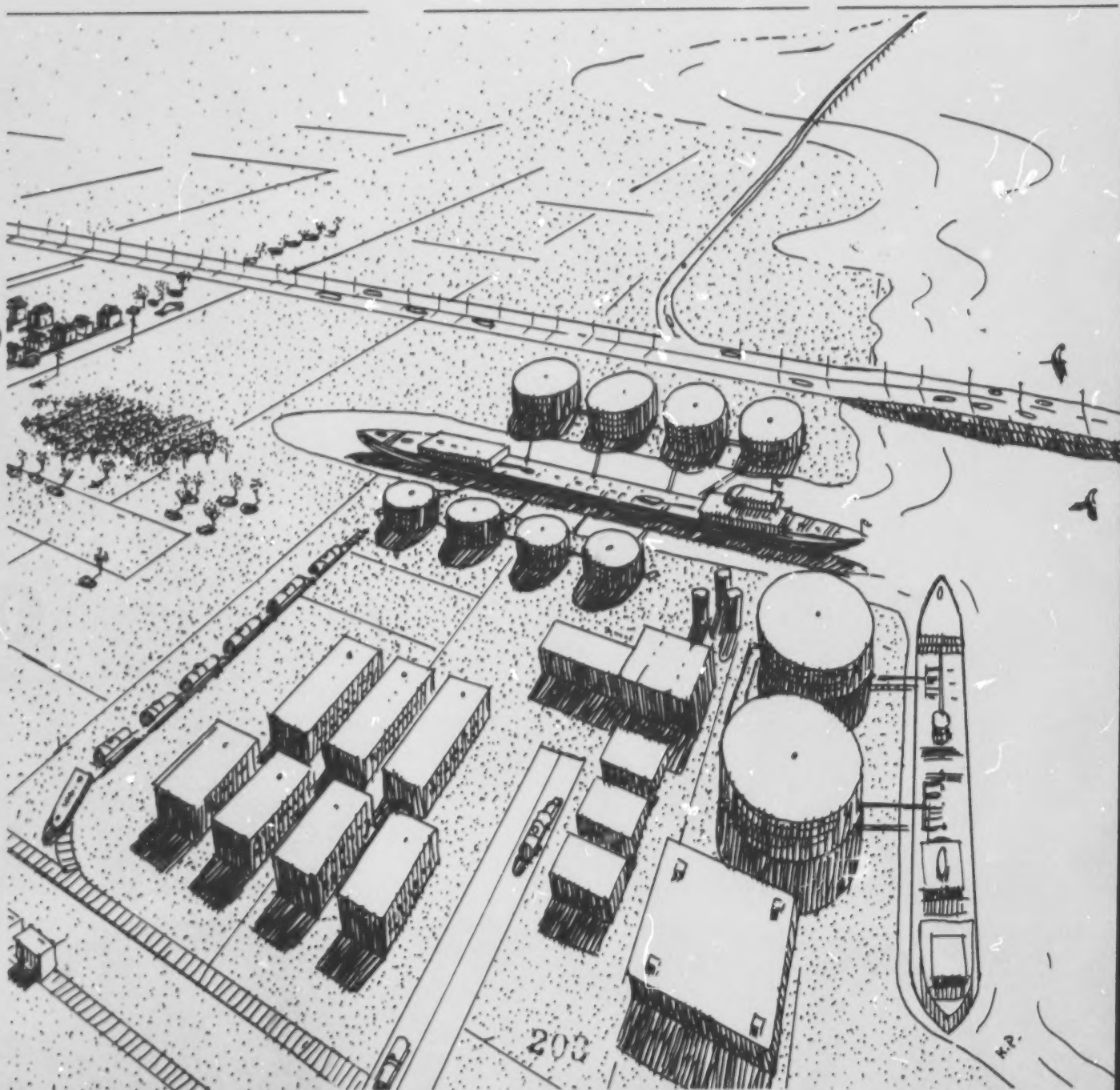
We hear the term "energy" constantly in the media. We know intuitively, that there is something "out there" (and internal, as well) that keeps our personal and societal process of activity and involvement going every day. We feel that energy is something definable, yet it is difficult to find a definition that is agreeable to everyone. For the purposes of environmental education, we feel the simplest definition is the most inclusive. Energy is a capacity to do work or bring about change. Energy, in this sense, includes not only naturally and humanly developed resources; but also materials, goods, and services which contain energy in many forms.

We live with the assumption that energy in its various forms is good for something, that it is essential in performing certain work-requiring tasks. Historically, Western industrialized civilization has attempted to dominate and control nature. What measure of success it has been able to effect has been due to this harnessing of energy for work. However, until recent events such as the Arab oil embargo, the findings of DDT in ocean life, and the popularization of the notion of space colonies, most people were not very concerned with how we obtain our energy, what it is used for, or what effects occur due to its use.

The list of energy/environmental issues that could be discussed is almost endless; the impact of technology, urbanization, land use and open space, conservation, and pollution of all kinds are simply those that are the most visible. However, all of these issues can be examined in terms of the relationships between energy and the work it performs. In environmental education, we can form a systemic framework for asking the right questions about energy, energy resources, and energy delivery in order to have a solid basis for personal decision-making and policy formation."

High School Energy/Environmental Education Training Model: Content Sourcebook
prepared by Far West Laboratory for Educational Research and Development, 1978
(Draft version)

RESOURCES—ENERGY



RESOURCES - ENERGY

<u>ACTIVITY TITLE</u>	<u>PAGE NUMBER</u>
ENERGY TIMELINE.....	191
COLONIAL KITCHEN.....	196
HOW TO SUCCEED BY REALLY TRYING.....	200
HOT WATER & ENERGY CONSUMPTION.....	208
WHERE DOES OUR FOOD COME FROM?.....	211
A KAYAK THROUGH EUROPE.....	215
A LOOK AT LEISURE.....	219
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DESALT OF THE EARTH.....	229
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Energy Timeline

Curriculum Topic

INDUSTRIAL REVOLUTION -
ENERGY RESOURCES

Subject

Social studies, Art, Science

Environmental Topic

ENERGY

Grade Level(s)

6 - 8

Site

Classroom

Skills

Locating and obtaining information

Author

Ed Lisk*

Objective

Students will be able to make a timeline to show 200 years of the development of energy development resources.

To The Teacher

This activity provides a comprehensive introduction to the modern energy story from the time of James Watt's contribution to the steam engine in 1776 to the demands for energy development today. Each activity sheet includes four 25-year segments, which can later be cut apart and joined into one long timeline. By gathering facts from encyclopedias and classroom discussion to complete the statements on the timeline, students will quickly gain an historical framework in which to consider the concerns of the present day energy situation. They can conclude that the changes in lifestyle depicted in bold type in each 25-year segment, growth in population, and the demand for goods and services are contributing factors to our growing energy dilemma. But you can help them see that humans have always been problem-solvers and that human inventiveness can help us continue the progress we began in this country 200 years ago.

Before You Begin

1. Make copies of student pages.
2. Provide reference materials.

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ACTIVITY

1. Distribute Student Pages, "Finish the Energy Timeline."
2. Direct students to research information on the various topics and complete their worksheets by filling in the blanks.
3. Instruct them to make a continuous timeline by cutting along the dotted lines and taping the sections together.
4. Ask students to research other events (wars, famous people, etc.)

Answers to Student Worksheets are as follows:

1776 - steam, 1783 - Paris, France and hot air, 1800 - Volta and electricity, 1804 - Trevithick, 1807 - steamboat, 1829 Joseph Henry, Michael Faraday, Henry, electricity, 1837 - reaper, Otis, Morse, 1859 - petroleum, 1860 - internal, 1884 - turbine, 1886 - Benz, 1892 - Rudolf Diesel, 1895 - electricity, 1903 - gasoline, 1905 - atomic, 1910 - T, 1926 - rocket, 1936 - hydroelectric, 1940 - nylon, 1942 - nuclear, 1952 - solar, 1957 - nuclear, 1970 - clean, 1973 - embargo, 1976 - conserve, energy

5. Place one timeline in the center of a bulletin board. Have each student illustrate one event from the timeline. When the illustrations are complete, tack them on the bulletin board around the timeline. Use a string or yarn to connect illustration of event with year on timeline.

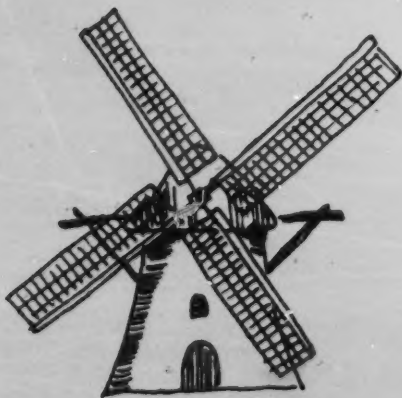
6. Discussion questions:

A. What energy form was used the most in the 1700's?, 1800's?, 1900's?

B. Has the rate of progress in the development of energy resources always been the same?

C. How has transportation changed as new energy forms and supplies have become available?

D. Relate the changes in industry to the availability of energy supplies.



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Related Activities

1. Assign the students to trace a particular industry or occupation from the year 1776 to 1978.
2. Ask students to make model steam engines or batteries.
3. Ask students to make models of the diesel, Wankel jet or internal combustion engine.

Resources

Hayes, Carlton J., and Margareta Faissler, Modern Times, Collier-MacMillan, 1965, Chapter 15.

Leinwand, Gerald, The Pageant of World History, Allyn and Bacon, 1974, Chapter 22.

Those Inventive Americans, National Geographic Society, Special Publication Division, 1971.

Platt, Nathaniel, and Muriel Drummond, Our World Through the Ages, Prentice-Hall, 1967, Chapter 16.

Credit

This activity is largely excerpted from U.S. Department of Energy, 1976, "The Energy Challenge," EEC #1012.

Words To Know

energy, combustion, generator, steam, turbine

Notes To Myself

Finish the Energy Timeline

Activity Master 1

..... cut

1776

In England James Watt puts two engines to work in factories & starts an energy revolution. The energy is



1783

Two men fly in a balloon at
The energy used is



Most people burn wood for heating and cooking and travel by horse or on foot.



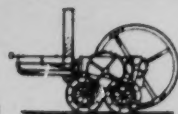
1800

In Italy, _____ invents the battery and gives his name to the volt. The energy produced is

..... cut

1804

An Englishman Richard _____ puts James Watt's engine on wheels and rails. He is the father of the railroad locomotive.



1807

Robert Fulton doesn't build the very first but he makes the one people first pay to ride on.



Wood continues to supply most household energy needs. But coal begins to do more in factories and railroad engines.

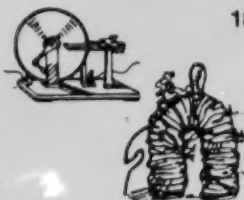
1821

First attempt to develop and market natural gas near Fredonia, N.Y.

..... cut

1829 An American named

and an Englishman named _____ each invents a generator. Who is first? The energy produced?



1837 Americans put new inventions to work. First comes McCormick's _____ then the steam _____ and _____ shovel by _____ the telegraph by _____



Railroads expand rapidly, hauling freight and passengers brave enough to stand the jolts and to risk hot cinders that often fly from the engine into their cars. England is first and America second in railroad locomotive production.

..... cut

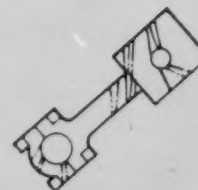
1859

Edwin Drake strikes oil in Pennsylvania beginning the _____ industry.



1860

Lenoir of France invents the _____ combustion engine.



An explosion inside a cylinder paves the way for the later invention of the automobile. An oil strike hastens the discovery of the fuel that will run it.

..... cut

..... cut

1850 1885 1890 1895

Coal and wood still furnish most of the energy in homes. "Iron horses" and real ones continue to take most people places. Although the electric bulb has been invented most people still use kerosene or gaslights to read by.

1884
In England, Charles Parsons perfects the steam and advances the development of electrical energy.



1886
Karl builds the 1st successful automobile.



1892
The oil-burning engine is invented by . Eventually, this engine will replace steam-powered ones.



1895
The power of Niagara Fall is harnessed to make

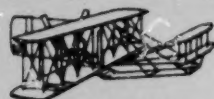


..... cut

1900 1905 1910 1915 1920 1925

1903

The engine in the Wright brothers' plane is powered by



1905 Albert Einstein develops a theory for measuring energy and prepares the way for the age.

1910

Ford makes the first Model car.



By the end of this period, many new homes have coal furnaces in the basement. And more and more cars appear in garages.

..... cut

1930 1935 1940 1945



1926

Robert Goddard tests a

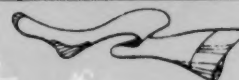


1936

Hoover Dam on the Colorado River is built to generate power.

1940

a fiber made from oil, coal, and water makes its first public appearance.



1942

In Chicago, Enrico Fermi sets off the first chain reaction.

Many homes convert from coal to natural gas for heating. Most families own at least one car and some have two.

..... cut

1950 1955 1960 1965 1970 1975

1952

Bell scientists raise hope for our energy future with the battery.



1957

The U.S. gets its first big electric power plant at Shippingport, Pa.

Demands for energy grow. America gets more people, more homes, more factories and businesses, more cars, more trucks, more buses, more planes. Demand grows faster than supply.

1970

Congress passes the

Air Act.



1973

OPEC nations

oil and produce an energy crisis.



1976 Americans continue to look for ways to the energy we have and find new sources.

Colonial Kitchen

Curriculum Topic

COLONIAL AMERICA

Subject

Social Studies

Environmental Topic

ENERGY-RESOURCES

Grade Level(s)

8

Site

Classroom

Skills

Inferring from illustrations

Author

Robert Slie

Objective

The student will be able to:

1. identify the colonists heavy dependence on the environment for daily necessities.

To The Teacher

The kitchen was the center of activity in colonial households. Therefore, it's contents are indicative of the life-style of the colonists, reflecting many of the necessities of colonial living. The colonial kitchen is a focal point for the study of colonial life with its heavy dependence on nature for daily necessities.

When the colonists landed in the "New World", they brought with them a few extra clothes, tools and various other supplies. Soon these supplies were depleted and had to be replenished. Since most of the colonists could not afford to buy many imported English goods, they had to support themselves from the resources obtainable in their own local area. Much of their food, clothing, and other daily essentials had to be extracted from the immediate environment.

Trees from the plentiful forests provided building materials for homes and furniture, as well as fuel for cooking and heating. The fire was enclosed in a fireplace made from rocks and stones taken off the land. The ashes from the fire were used to make lye for soap. The boiled sap of the maple tree was used for syrup and sugar. Bayberry bushes offered a source of wax for candles.

The soil produced corn for food and flax for linen. Fields and streams supported cows for milk and butter and sheep for wool and meat. The fat from both animals was another source of tallow for candles.

High taxes on imported goods imposed by the English government prior to the Revolutionary War created a greater need for economic independence and a heavier reliance on the local environment to produce the basic necessities of life.

Before You Begin

Preparation: Make copies of the Student Page, "Colonial Kitchen" for all students.

Words To Know

flax, churn, lye, tallow, linen, environment, independence

ACTIVITY

1. Have students identify and label the kitchen contents indicated in the illustration on the ditto sheet titled "Colonial Kitchen".
2. With the class use the following questions to help students consider and understand the function of each article shown:
 - a. What two ways could the kitchen be lighted?
 - b. Of what use is a spinning wheel?
 - c. What kind of foods did the colonists eat? Why?
 - d. What is a churn?
 - e. Of what is a fine table cloth often made?
 - f. What types of building materials did the colonists use?
 - g. How was soap made?
 - h. How do we get sugar today? How did the colonists get their sugar?
3. Then individually, have students state or explain the source in the environment from which the labeled articles were derived (i.e. sugar-sap from the maple tree).

Related Activities

1. Have students give a demonstration of such activities as soap or candle making.
2. Visit a reproduction or restoration of a colonial village such as Mystic Seaport or Sturbridge Village.
3. Discuss some of the old colonial crafts that are coming back to today as hobbies and/or lifestyles.

Resources

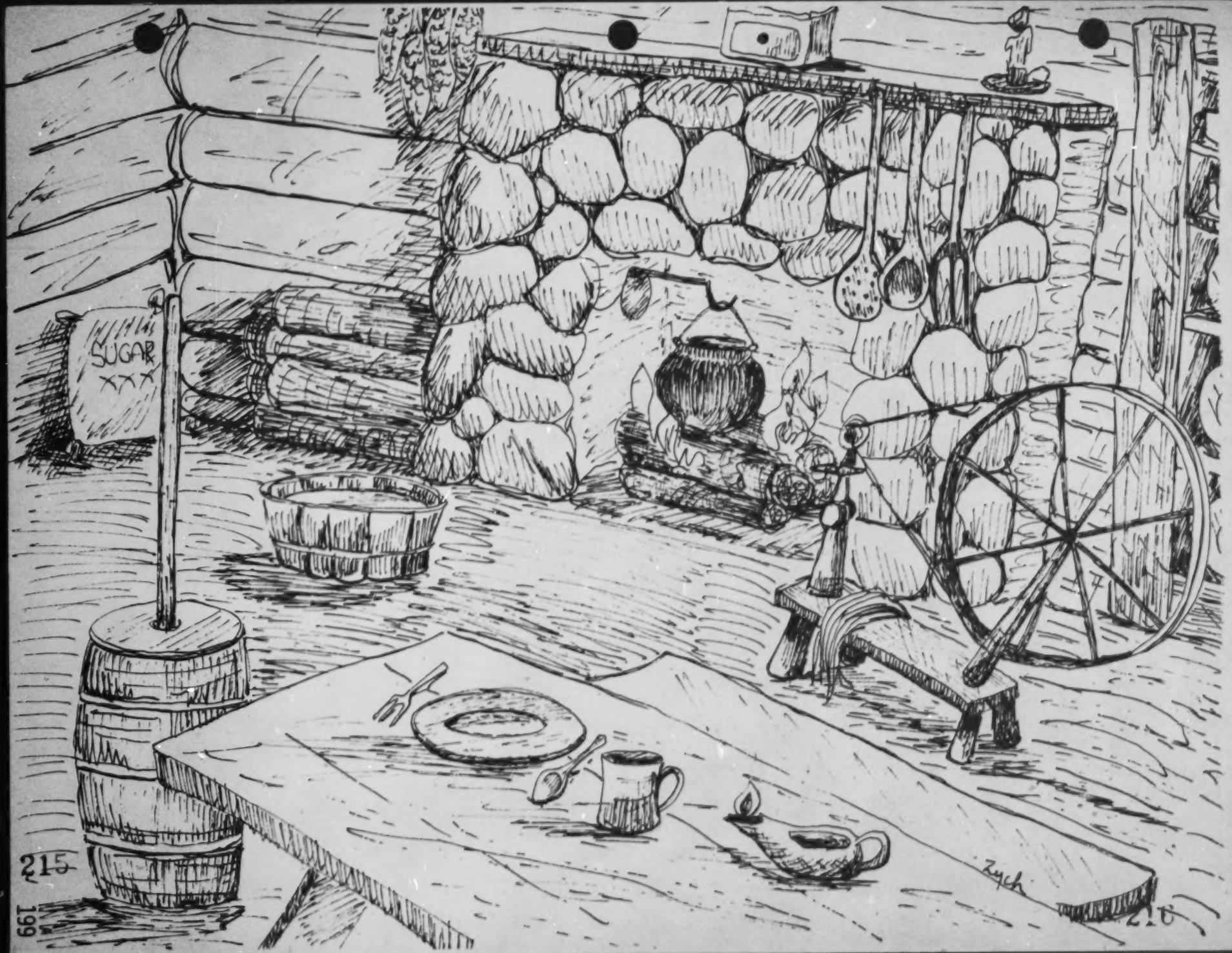
Fisher, Margaret, Mary Jane Fowler, and Jerry E. Jennings, Colonial America, Grand Rapids, Mich., the Fedeler Company, 1976.

Langdon, William C., Everyday Things in American Life, 1607-1776, New York, Charles Scribner's and Sons, 1937.

Rich, Louise, The First Book of the Early Settlers, New York, Franklen Watts, Inc., 1959.

Notes To Myself

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How to Succeed by Really Trying

Curriculum Topic

INDUSTRIAL REVOLUTION
CAREER AWARENESS

Subject

Social Studies
Language Arts

Environmental Topic

ENERGY

Grade Level(s)

7,8

Site

classroom

Skills

reading
analyzing

Author (revised by L.Schaefer)
NSTA Energy, The Environment
and the Economy Curriculum
Project.

Objective

Students will be able to:

1. make efficient use of case studies as an aid to social understanding.
2. contrast the great wealth and power the Industrial Revolution brought to us as a nation with the great social consequences it had on people
3. explore the wide gulf that exists between human and mechanical energy

To The Teacher

This lesson uses two case studies about young people who lived before and during the Industrial Revolution. Students will be asked to describe the effects a major change can have on the lives of people by reading the two accounts and answering questions.

21

This lesson emphasizes the place that the production of goods has in the everyday lives of people. It deals realistically with the need to adjust to the rapid changes that affect daily living in an increasingly complex society. Learning how young people over the years have responded to challenges can help your students discover the importance of learning to make adjustments now.

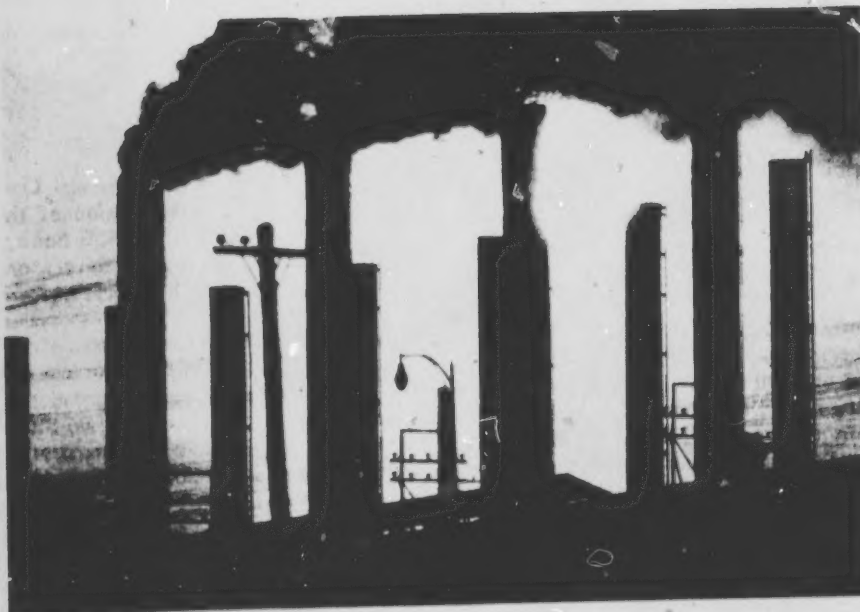
The activity takes one to three class periods.

Before You Begin

Duplicate copies of case studies 1 and 2 for each student.

Words To Know

industrialization
contract



EPA-Documentica/ LeRoy Woodson

ACTIVITY

1. Give pre-test. (optional)
2. Discuss why so many people work in America. List the reasons on the board.
3. Then you might ask:
 - a. How does having a job affect your everyday life?
 - b. How does a parents' job affect their everyday life?
4. Turn student's attention to the case studies. Have student read each story and answer discussion questions which follow each story. The stories include excerpts from The Shoe Industry by Frederick J. Allen and Sister Carrie by Theodore Dreiser.

POTENTIAL ANSWERS TO DISCUSSION QUESTIONS:

Case Study #1

1. What was the purpose of the contract?
(The contract set down the responsibilities of both the Apprentice and the Master Craftsman.)
2. According to the contract, what did the Master provide?
(Food, clothing, shelter, some schooling and to teach him the trade.)
3. Suppose I were to say that under this contract the Master and the Apprentice were exchanging energy for energy - would I be right? Explain.
(One example might be that the Master gave John food (food energy) and John turned the food energy into muscle power to do work.)
4. Do you think the contract gave John a fair deal? Why?
(After six years, John would have a marketable skill.)

Case Study #2

After students have finished Dreiser's story about Carrie, have them respond to the following questions:

1. How did Carrie's fellow workers cooperate in helping her when she was in need?
(They cooperated by slowing down their work so that too many shoes would not pile up in front of Carrie. One worker urged her to stand to ease her aching muscles.)
2. List several examples of the unappealing working conditions in the shoe factory.
(Long work day, unpleasant smells, dirt, noise, frantic speed to keep the line going, impersonal machines, etc.)
3. There was a very long sentence in the story that described the repetitive work of the assembly line quite well. Read aloud the cadence that makes the reader feel the ache that comes with performing a single mechanical movement over and over. Find the sentence and write it down. What does the sentence tell you about the gulf that exists between human energy and mechanical energy?

(The sentence describes the time before the lunch break. It reads: "Her hands began to ache at the wrists and then in the fingers, and towards the last she seemed one mass of dull, complaining muscles, fixed in an eternal position and performing a single mechanical movement which became more and more distasteful, until at last it was absolutely nauseating." The sentence tries to help the reader sense the ceaseless movement of the machine in contrast to the weakening energy of the human being. One senses the power of the created machine over its creator, the human.)

4. The end of the story tells you something about Carrie's feelings about the job. Summarize her feelings in one sentence. (She felt humiliated, worn out, and subdued.)

5. How is Carrie's work more of a job while John Goederson has a career to look forward to? What is the difference? (Carrie works at one machine and is learning a skill which will probably not be very useful anywhere else. John, on the other hand, is learning his life's work.)

End the lesson with a discussion of the importance of citizens having the freedom to choose a job.

Credit

"Energy Engines and the Industrial Revolution," from Inderdisciplinary Student/Teacher Materials in Energy, The Environment and the Economy, developed for the U.S. Department of Energy by National Science Teachers Assoc., October, 1977.

Notes To Myself

STUDENT PAGE

How to Succeed by Really Trying

Case Study #1

A Contract for Apprenticeship in Shoemaking Between
a New York Shoemaker and John Goederson

The Contract

That John Goederson, now aged fourteen years, eight months, and twenty-seven days, by and with the consent of his stepfather, John Wright, and his mother, Mary Wright, hath...of his own free will and accord, put himself Apprentice to Frederick Seely of the city of New York, Cordwainer...to serve...until the full end and term of six years, three months and three days next ensuing during all of which time the said Apprentice where readily obeyed...He shall not contract matrimony within the said term; at Cards, Dice, or any other unlawful game shall he not play... He shall not absent himself, day or night, from his Master's service without leave, nor haunt ale-houses, taverns or playhouses; but in all things behave as a faithful apprentice ought to do...And the said Master shall use the utmost of his endeavors to teach, or cause to be taught or instructed the said Apprentice in the trade, or mystery, of a Cordwainer, and procure and provide for him sufficient meat, drink, washing, lodging and clothing fit for an Apprentice during the said term of service and four quarters of night schooling during the said term. In WITNESS WHEREOF the said parties have interchangeably set their hands and seals hereunto. Dated the sixth day of August, in the thirty-fifth year of the Independence of the United States of America, and in the year of our Lord eighteen hundred and eleven.

Frederick J. Allen, The Shoe Industry,
1916, pp. 31-32

1. What was the purpose of the contract?
2. According to the contract, what did the Master provide?
3. Suppose I were to say that under this contract the Master and the Apprentice were exchanging energy for energy - would I be right? Explain.
4. Do you think the contract gave John a fair deal? Why?

Case Study #2

THE JOB

After:

It was with weak knees and a slight catch in her breathing that she came up to the great shoe company at Adams and Fifth Avenue and entered the elevator. When she stepped out on the fourth floor there was no one at hand, only great aisles of boxes piled to the ceiling. She stood, very much frightened, awaiting someone.

Presently Mr. Brown came up. He did not seem to recognize her.

"What is it you want?" he inquired.

Carrie's heart sank. "You said I should come in this morning to see about work--"

"Oh," he interrupted. "Um - Yes. What is your name?"

"Carrie Meeber."

"Yes," he said. "You come with me."

He led the way through dark, box-lined aisles which had the smell of new shoes, until they came to an iron door which opened into the factory proper. There was a large low-ceilinged room, with clacking, rattling machines at which men in white shirt sleeves and blue gingham aprons were working. She followed him diffidently through the clattering automatons, keeping her eyes straight before her, and flushing slightly. They crossed to a far corner and took an elevator to the sixth floor. Out of the array of machines and benches, Mr. Brown signalled a foreman.

"This is the girl," he said, and turning to Carrie, "You go with him." He then returned, and Carrie followed her new superior to a little desk in a corner, which he used as a kind of official center.

"You've never worked at anything like this before, have you?" he questioned rather sternly.

"No, sir," she answered.

He seemed rather annoyed at having to bother with such help, but put down her name and then led her across where a line of girls occupied stools in front of clacking machines. On the shoulder of one of the girls who was punching eye holes in one piece of the upper, by the aid of the machine, he put his hand.

"You," he said, "show the girl how to do what you're doing. When you get through come to me."

The girl addressed rose promptly and gave Carrie her place.

"It isn't hard to do," she said, bending over. "You just take this like so, fasten it with this clamp, and start the machine."

She suited action to word, fastened the piece of leather, which was eventually to form the right half of the upper of a man's shoe, by little adjustable clamps, and pushed a small steel rod at the side of the machine. The machine jumped to the task of punching, with sharp snapping clicks, cutting circular bits of leather out of the upper, leaving the holes which were to hold the laces. After observing a few times, the girl let Carrie work it alone. Seeing that it was fairly well done, she went away.

The pieces of leather came from the girl at the machine to her right, and were passed on to the girl at her left. Carrie saw at once that an average speed was necessary or the work would pile up on her and all those below would be delayed. She had no time to look about, and bent anxiously to her task. The girls at her left and right realized her predicament and feelings, and, in a way, tried to aid her, as much as they dared, by working slower.

At this task she labored incessantly for sometime, finding relief from her own nervous fears and imaginings in the humdrum, mechanical movement of the machine. She felt, as the minutes passed, that the room was not very light. It had a thick odor of fresh leather, but that did not worry her. She felt the eyes of the other help upon her, and troubled lest she was not working fast enough.

Once, when she was fumbling at the little clamp, having made a slight error in setting in the leather, a great hand appeared before her eyes and fastened

the clamp for her. It was the foreman. Her heart thumped so that she could scarcely see to go on.

"Start your machine," he said, "start your machine. Don't keep the line waiting."

This recovered her sufficiently and she went excitedly on, hardly breathing until the shadow moved away from behind her. Then she heaved a great breath.

As the morning wore on the room became hotter. She felt the need of a breath of fresh air and a drink of water, but she did not venture to stir. The stool she sat on was without a back or footrest, and she began to feel uncomfortable. She found, after a time, that her back was beginning to ache. She twisted and turned from one position to another slightly different, but it did not ease her for long. She was beginning to weary.

"Stand up, why don't you?" said the girl at her right, without any form of introduction. "They won't care."

Carrie looked at her gratefully. "I guess I will," she said.

She stood up from her stool and worked that way for a while, but it was a more difficult position. Her neck and shoulders ached in bending over...

Carrie at last could scarcely sit still. Her legs began to tire and she wanted to get up and stretch. Would noon never come? It seemed as if she had worked an entire day. She was not hungry at all, but weak, and her eyes were tired, straining at the one point where the eye-punch came down... The halves of the uppers came piling down steadily. Her hands began to ache at the wrists and then in the fingers, and towards the last she seemed one mass of dull, complaining muscles, fixed in an eternal position and performing a single mechanical movement which became more and more distasteful, until at last it was absolutely nauseating. When she was wondering whether the strain would ever cease, a dull-sounding bell clanged somewhere down an elevator shaft, and the end came. In an instant there was a buzz of action and conversation. All the girls instantly left their stools and hurried away in an adjoining room. Men passed through, coming from some department that opened on the right.

The whirling wheels began to sing in a steadily modifying key, until at last they died away in a low buzz. There was an audible silence, in which the common voice sounded strange.

Carrie got up and sought her lunch box. She was stiff, a little dizzy, and very thirsty. On the way to the small space portioned off by wood, where all the wraps and lunches were kept, she encountered the foreman, who stared at her hard.

"Well," he said, "did you get along all right?"

"I think so," she replied very respectfully,

"Um," he replied, for want of something better, and walked on...

The place smelled of the oil of the machine and the new leather -- a combination which, added to the stale odors of the building, was not pleasant even in cold weather.

The floor, though regularly swept every evening, presented a littered surface. Not the slightest provision had been made for the comfort of the employees, the idea being that something was gained by giving them as little and making the work as hard and unremunerative as possible.... The washrooms were disagreeable, crude, if not foul places, and the whole atmosphere was sordid....

By three o'clock she was sure that it must be six, and by four it seemed that they had forgotten to note the hour and were letting all work overtime. The foreman became a true ogre, prowling constantly about, keeping her tied down to her miserable task... When six o'clock came, she hurried eagerly away, her arms aching and her limbs stiff from sitting in one position...

Carrie turned her face to the West with a subdued heart. As she turned the corner, she saw through the great shiny window the small desk at which she had applied. There were the crowds, hurrying with the same buzz and energy-yielding enthusiasm. She felt a slight relief, but it was only at her escape. She felt ashamed in the face of better dressed girls who went by. She felt as though she should better be served, and her heart revolted.

Theodore Dreiser, Sister Carrie

1. How did Carrie's fellow workers cooperate in helping her when she was in need?
2. List several examples of the unappealing working conditions in the shoe factory.
3. There was a very long sentence in the story that described the repetitive work of the assembly line quite well. Reading aloud the cadence makes the reader feel the ache that comes with performing a single mechanical movement. Find the sentence and write it down. What does the sentence tell you about the gulf that exists between human energy and mechanical energy?
4. The end of the story tells you something about Carrie's feelings about her job. Summarize her feelings in one sentence.
5. How is Carrie's work more of a job while John Goederson has a career to look forward to? What is the difference?

Hot Water & Energy Consumption

Curriculum Topic

ECONOMICS

Subject

Social Studies

Environmental Topic

RESOURCES - ENERGY

Grade Level(s)

6 - 8

Site

Classroom, home

Skills

Interpreting data
Locating and obtaining information
Brainstorming
Computing

Author

Ed Lisk

Objective

The student will be able to calculate the quantity and cost of the hot water used in the home.

To The Teacher

After space heating and cooling, water heating is the largest consumer of energy in the home. As much as 15% of residential energy is used for water heating. This accounts for 3% of all energy used in the United States.

There are many ways hot water can be conserved:

- a) Insulate hot water pipes and hot water tank.
- b) Don't overheat water. 140 degrees F is adequate for dishwashing. (Over this temperature wastes 3% of total energy for every 10 degrees F).
- c) Repair dripping faucets.
- d) Take showers which generally use one-half the amount of water, compared with baths.

Before You Begin

Duplicate and distribute student worksheet. Students will need pencils. Use a calculator if available.

Words To Know

BTU, kilowatt-hour

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ACTIVITY

1. Begin the investigation with a brainstorming session during which students list all ways that hot water is used in the home.
2. When the list from step 1 is sufficiently exhaustive, prioritize the hot water used based on the class estimation of the quantity of hot water needed for each task.
3. Have each student complete the calculations on the "Hot Water Usage" worksheet.
4. Question seven asks students to consider ways of cutting down hot water energy use in their homes. Here students may want to initiate research outside of the classroom or to brainstorm as a class a list of ways to eliminate waste in the production and use of hot water in the home.

Related Activities

1. Encourage students to implement energy saving techniques into their homes with parental cooperation, and then to look for savings in the monthly utility bill.
2. As a class, analyze hot water energy consumption for the entire school based on a random sample of the school population based on the worksheet.
3. Let individual students investigate alternative energy sources and their potential for meeting hot water needs in Connecticut.

Resources

Foster, Wm. H., Homeowners Guide to Solar Heating and Cooling, Tab Books, Blue Ridge Summit, PA, 1974

Clegg, Peter, New Low Cost Sources of Energy for the Home, Garden Way Publishing, 1975

Home Energy Savers Workbook, Home Energy Savers Program, Department of Planning and Energy Policy, 20 Grand Street, Hartford, CT 06115, 1977 (for toll free info call 1-800-842-1648)

Morrison, James W., The Complete Energy Saving Home Improvement Guide, Arco Publishing Co., 1976

Notes To Myself

STUDENT PAGE

STUDENT WORKSHEET

- GIVEN:
1. THE AVERAGE AMERICAN FAMILY USES 20 GALLONS OF HOT WATER PER PERSON, PER DAY.
 2. IT REQUIRES APPROXIMATELY 800 BTU'S PER GALLON TO HEAT AND MAINTAIN WATER AT 140 DEGREES F.
 3. THE COST OF 100,000 BTU'S OF ENERGY IS:
OIL - 100,000 BTU'S (1 GAL.) = \$.50
NATURAL GAS - 100,000 BTU'S (120 CUBIC FEET) = \$.40
ELECTRICITY - 100,000 BTU'S (30 KILOWATT-HOURS) = \$1.35

QUESTIONS:

1. HOW MANY PERSONS ARE IN YOUR FAMILY? _____
2. HOW MANY GALLONS OF HOT WATER DOES YOUR FAMILY USE? PER DAY _____
PER WEEK _____ PER MONTH _____ PER YEAR _____
3. WHAT ARE THE NUMBER OF BTU'S NECESSARY FOR YOUR ENERGY NEEDS?
PER DAY _____ PER WEEK _____ PER MONTH _____
PER YEAR _____
4. WHAT FUEL DOES YOUR HOME USE FOR HEATING HOT WATER? _____
5. CALCULATE THE COST OF HOT WATER IN YOUR HOME FOR YOUR FAMILY.
PER DAY _____ PER WEEK _____ PER MONTH _____
PER YEAR _____
6. FIND ANOTHER MEMBER OF THE CLASS WHOSE FAMILY USES THE SAME NUMBER OF BTU'S BUT USES A DIFFERENT ENERGY SOURCE. COMPARE YOUR RESULTS WITH HIS/HERS. _____

7. LIST 5 WAYS YOU CAN REDUCE HOT-WATER ENERGY USAGE IN YOUR HOME.
A. _____ D. _____
B. _____ E. _____
C. _____
8. ESTIMATE THE PERCENTAGE ENERGY-SAVINGS IF THESE 5 WAYS WERE IMPLEMENTED FOR A YEAR. _____

Where Does Our Food Come From?

Curriculum Topic

GEOGRAPHY

Subject

Social Science

Environmental Topic

ENERGY-RESOURCES-ECONOMICS

Grade Level(s)

6-8

Site

Classroom and Home

Skills

Obtaining information,
organizing information,
evaluating information,
reading maps

Author

Orah Elron

Objective

Students will be able to:

1. discuss that most of our food comes from far away and that different foods are grown in different geographic areas,
2. read maps in order to locate food origins,
3. decipher all the information written on food wrappings.

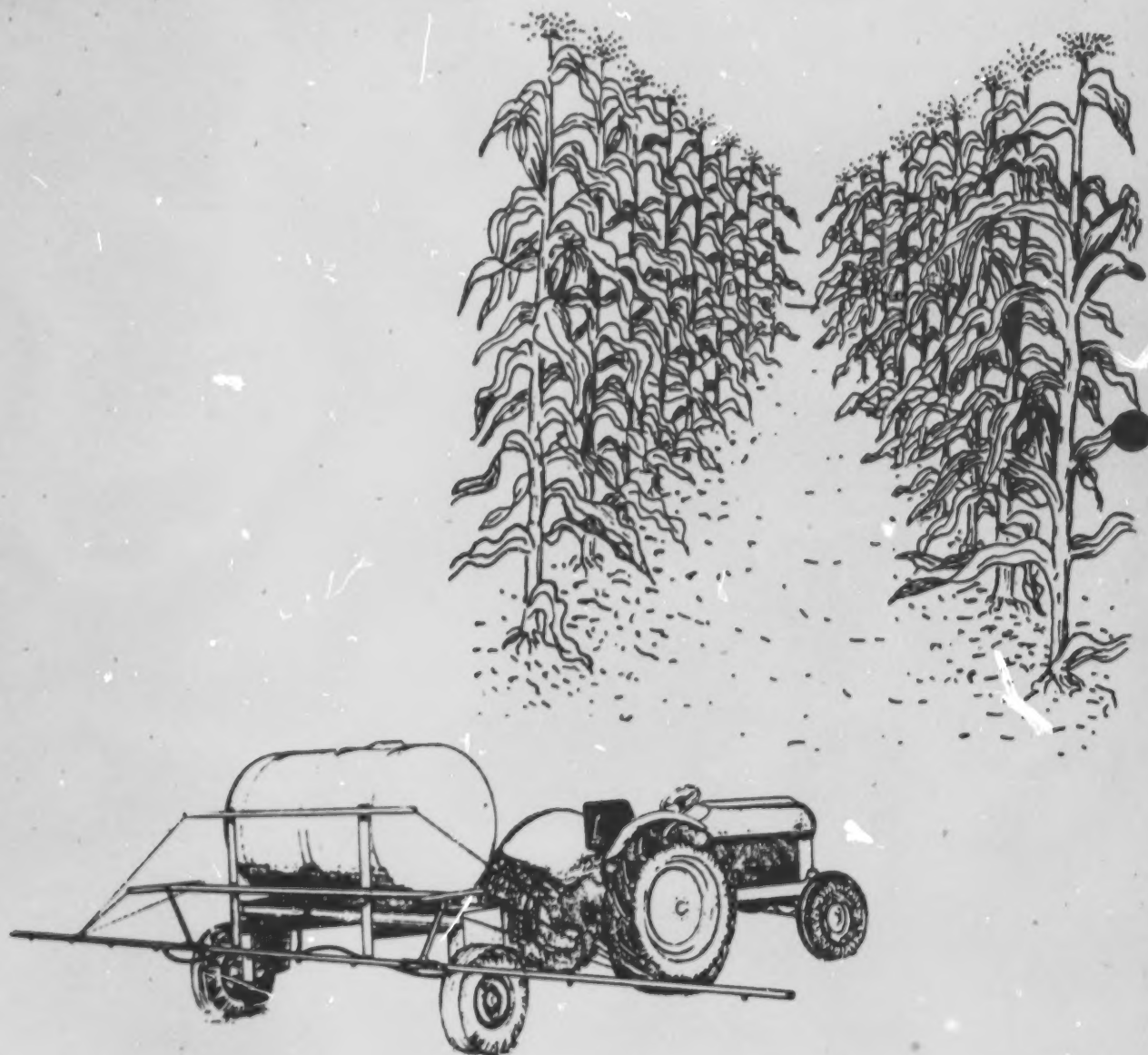
To The Teacher

Almost all of the processed food we eat is placed in containers, bags, cans or cardboard boxes. By law each of these wrappings bears details as to the content and origin of the food (in addition to advertisements, recipes, quantity and price of the product.) Most students know little about the origin of food. For them milk comes in cardboard containers and fruit in plastic bags. Only in the last few years have many families started to grow some vegetables and berries or fruit in their own gardens. This activity is to motivate students to think about the different areas in the United States and in other regions of the world where food is grown and exported to the places where it is consumed. Students will also find that some products are not only grown but also packaged in a different place. (Tea, although packaged in Norwalk, Connecticut can hardly have grown there and tuna canned in Skokie, Illinois was probably not caught there.)

The students will use the atlas and library books to find the logical origins of many foods in order to complete the information obtained from the food label. They will have to use maps to determine if the origin is the same as the packaging location. For exact information the teacher should provide an encyclopedia and a good atlas during this activity.

Before You Begin

import, export, manufactured, distributed



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ACTIVITY

1. Ask students to write down all foods they ate the day before. (if necessary supply a worksheet to be filled out.)
2. Ask students if they know where the different foods come from. Our milk, eggs, bread, fruit....Where does it grow, where is it packed? How is it transported?
3. Let students list, at home or at the food store, the origins of as many different foods as they can. A worksheet is included and calls for the Form of Wrapping (box, plastic or paper bag, can etc.), the Place of Packaging and the Place the Food was Grown (if they can locate it.)
4. Discussion question:
 - a. Are there many foods that grow in our own area? Which ones?
 - b. Are there many foods we import from outside the U.S.? Which ones?
 - c. Can you locate the regions where most of a certain food comes from (grain, fruit, vegetables, meat)?
 - d. Do all students have the same answers?
 - e. Can you find any explanation to these differences?

Related Activities

1. It will also be interesting to consider the economics of food processing - how high is the cost of wrapping as compared to the cost of the food itself?

Resources

Halperin, Miryam, and Orah Elron, "Man and His Environment," Matal Science for Elementary School, Tel Aviv University, Israel, 1973.

Notes To Myself

STUDENT PAGE

FOOD	FORM OF WRAPPING	PLACE OF PACKAGING	PLACE WHERE GROWN
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100

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A Kayak Through Europe

Curriculum Topic

GEOGRAPHY (EUROPE)

Subject

SOCIAL SCIENCE

Environmental Topic

ENERGY - RESOURCES

Grade Level(s)

6-8

Site

Classroom (library)

Skills

Map reading and interpreting,
measuring

Author

Orah Elron

Objective

Students will be able to:

1. read and interpret a map,
2. accumulate facts about Central Europe's geography, namely cities and rivers,
3. learn to appreciate energy saving ways of travel.

To The Teacher

Environmental studies is a global discipline, thus it is necessary to motivate students to read carefully the maps of central and northern Europe and the North Balkan countries. In this activity students will learn to interpret these maps so that they can imagine how these places look, the lifestyle of the people, and describe in detail the places marked on the maps. Students should also have easy access to encyclopedias (Encyclopedia Britannica, if possible) to read further information about the places they "visit" on their trip.

In our age of motorized travel, students will compare long distance travel by waterway. The student will travel on three rivers--the Rhone, the Rhine and from the Inn to Danube. These trips are of different lengths and the teacher should divide the class in groups of unequal size or give the longer trip to those students that are able to handle it.

A description of each trip follows:

1. The Rhone--from Furka Pass (Berner Oberland) to Marseilles in the Mediterranean - 812 km (505 miles) it passes through Vallais valley between two high mountain chains of the Alps--south: Matterhorn 14,713 feet high and approachable from the village of Zermatt (20 miles) from the Rhone Valley. Lausanne - Lake Geneva - Geneva crosses the border to France: Lyon - Avignon (pope's residence before Rome) to Marseilles - languages: German and French.

2. The Rhine--from St. Gotthard Pass north to Netherlands Atlantic 1320 km (820 miles) - Bodensee (Lake of Constance) (Germany) Schaffhausen (waterfall 24 miles high) - Basel (Switzerland) three country corner, from Basel north the Rhine is the border between France, Alsace and Germany, Black Forest - Strasbourg (Fr.) - Koblenz (Germ.) Bonn (capital) - Cologne - side trip to see the Dom in Aachen (30 km) - Arnhem (Netherlands) - Rotterdam - the Hague; languages are German, French, and Dutch.

3. The Danube--longest river in Europe 2850 km. Our trip starts on the Inn, longest tributary of the Danube, length 510 km and flows into Danube at Passau, Austria (length of the trip 2360 km (1467 miles) Start: Silvaplana (Switzerland) (St. Moritz) on Maldja Pass - Engadin famous beautiful river valley - crosses border to Austria (at Navders) to Innsbruck (Tyrol) crosses border to Germany, Bavaria (side trip to Munich) back to Austria: Passau (into Danube, that is already a wide, fairly quiet river with big ships) - Linz - Melk (Wachau, beautiful hill with vineyards) - Vienna - to Hungarian border - Budapest (Yugoslavic border) Belgrade - from there the Danube serves as border between Romania in the north, Bulgaria in south - to Black Sea delta (Galati and Braila); languages: German, Hungarian, Romanian (Yugoslavic, Bulgarian)

The trip along the Danube has been described by a group of six USA students in the National Geographic Magazine, July, 1965.

The trip along the Rhine is described in the National Geographic Magazine, April, 1967.

Both with beautiful photographs and many details. There was also a TV program "Yankee Sails Across Europe" on April 8, 1967.

(Information available through National Geographic Society, Washington DC 20036)

Before You Begin

Materials: atlas to each pair of student, encyclopedia and geographic information about Switzerland, Germany, France, Austria, Netherlands, Hungary, Romania.

Students should have string to measure distances on the map and be familiar with the scales of maps, and the metric equivalents for length and height measurements.

It might be helpful to have pictures and traveling information (often free at travel agencies) about the above countries.

ACTIVITY

1. Introduce the activity through short story (told to the class)
On your birthday you received an inflatable kayak as a present, something you had been dreaming about for a long time. These boats are easy to carry. With some instruction one person can ride in the kayak even in very white, rough water. You also saved some money through the school year by doing occasional jobs, and thus you can fulfill your big wish to travel. Last year in your class, a foreign student from Switzerland invited you to his family's home in Interlaken, Switzerland. The friend's parents pick you up at Zurich's airport and bring you to their home near the snow covered peaks of the Alps. You are able to spend a wonderful week at their house, but you wish very much to do some traveling of your own, having taken with you the new kayak and your sleeping bag.
2. Students can then divide into three groups to choose one of the rivers: a) the Rhone, b) the Rhine, c) the Danube on which to travel.
3. With the help of an atlas (for each group of students) and geographic information about the relevant areas, students will describe their trip on one of the three large rivers. Each group can further divide the trip on the river among the student in the group so that they can, as a group, describe the entire length of the trip.
4. Questions for the students to consider:
 - a. How long is your trip from start to the end?
 - b. How much money would you spend on gas if you traveled this distance by car? Investigate European gas prices per liter.
 - c. How many miles (or km) do you intend to travel each day?
 - d. How many days will you be on the river? (Trip on Danube described in National Geographic Magazine, 1965 lasted six weeks.)
 - d. How far from your friend's house will you have to travel to the starting point of your voyage? (you get to this place by car from your friend's house in Interlaken).
 - e. List starting point and (at least) five interesting places that you pass on your way. Where does the river reach the sea--which ocean? What is the name of the harbor?
 - f. Which countries do you pass? What language do they speak? What currency do they use? Can you estimate how much money you would spend on this trip?
 - g. You have enough money to travel 100 miles by railroad or bus on a trip away from the river. What additional places close to the river will you visit on your way?
5. After having done their individual work, each group should combine all their information for a description of the whole journey and places of interest visited.

Related Activities

1. Try to write a more detailed travel report including pictures, adventures on the way, information about places you visited.
2. Collect important phrases in the languages you needed on your journey - "Greetings", "Where do we find..?", "How far to...?" "What is the price of...?", "Thank you", "Please"

Resources

National Geographic, July 1965, April 1967.

Notes To Myself

Credit: drawing - Cecelia Zych



A Look at Leisure

Curriculum Topic

CULTURE

Subject

Social Studies

Environmental Topic

ENERGY-RESOURCES

Grade Level(s)

6-7-8

Site

Classroom

Skills

organizing information
analyzing information
identifying feelings for alternatives

Author

Pat Perrella

Objective

Students will be able to examine the relationship between recreational activities and energy usage.

To The Teacher

With increased technology, mechanization has taken over many areas of our lives, and increased mechanization requires more energy resource consumption. The pattern of recreational activity in the United States is in many instances geared to high energy use. Many "sports" and leisure-time activities rely less and less on human energy output and more on mechanized devices which consume energy at high costs.

In the discussion section of the activity, students may be surprised when they actually tally up and see how much of their personal recreational activity requires large amounts of energy from our environment.

Before You Begin

Each student will need a copy of the chart on which they will list recreational activities and fill in information about these activities.

ACTIVITY

1. Distribute the Recreational Activities Chart to each student.
2. Ask students to list 10 recreational activities in which they participate or have an interest. Stress that these need not all be sports, but anything engaged in for recreation (watching a baseball game on TV, playing tennis, sailing, riding a motor bike, going to a movie, camping, etc.).
3. Next, students will judge the healthfulness of each activity and record their conclusions by checking the appropriate column on Recreational Activities Chart.
4. The next column heading is blank. Instruct students to fill in the title: Type of Energy Required. For each of their listed activities students then indicate what type(s) of energy is (are) required for them to take part: muscular energy, sun, wind, water, electricity, gasoline, natural gas, coal, etc.

Discussion Questions:

- a. How many of your activities require that you use some muscular energy?
 - b. How many of your activities require that you use large amounts of energy supplied by the environment? Compare columns 5 & 6.
5. Students will next place a check beside each activity on their list which they think their grandparents might have engaged in as teenagers. How has the pattern of recreational activities changed since your grandparents' time?
 6. Ask students to rank order (1-10) their activities according to preference (1 - most preferred to 10 - least preferred).
 7. Have students rank order (1-10) their recreational activities on the list from the least energy consumptive (1) to the most energy consumptive (10).

Discussion Questions:

- a. Is the general pattern of recreational activity revealed by the activity lists one of increasingly high energy use? If so, what can be done about it?
 - b. What can you do about it?
8. Explain to students: "There is an energy shortage and everyone must cut back energy consumption 50%. You will have to eliminate 5 of your 10 activities. Which would they be? Place a check in the last column.

Additional Discussion Questions:

- a. Using the categories on your chart, how would you rate a major event like the Indianapolis 500-Mile Auto Race?
- b. How would you compare tent camping with vacationing in a mobile home?
- c. In your opinion, is it desirable to build huge sporting arenas like the Astrodome in Texas (an enclosed, climate-controlled arena where many different sports are played)?

Related Activities

Assign a project in which students research other countries to find out the most popular recreational activities and how this is related to the level of industrialization and energy use in the country.

Resources

Wheatley, J. and H. Coon, Teaching Activities In Environmental Education, Volume II, Ohio State University, 1974, p 168.

Notes To Myself



STUDENT PAGE

Recreational Activities Chart

1	2					3	4	5	6	7
Activity	Health						Activities Grandparents Might Have Engaged In? (✓)	Rank Preference (1-10)	Rank most energy con- sumptive (1) to least energy consumptive (10)	Check the five you would eliminate during cutback
	very healthful	somewhat healthful	no effect	somewhat harmful	very harmful					
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										
13.										
14.										
15.										

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The Squeeze is On

Curriculum Topic

ECONOMICS

Subject

Social Studies

Environmental Topic

ENERGY - RESOURCES

Grade Level(s)

7,8

Site

Classroom

Skills

Recognizing problems,
analyzing information,
group skills

Author

Pat Perrella

Objective

Students will be able to:

1. analyze factors which affect the supply of and demand for a product and
2. predict how these factors affect price.

To The Teacher

When we ask, "What is the demand for a product?", what we really want to know is, "at any given price, how much of the product will be bought?" This demand schedule is determined by our lifestyle. That is, a change in demand stems from shifts in our tastes and preferences, incomes, and relative values we assign to different goods and services and results in different quantities purchased at any given price. If the cost of supplying the product and all other factors remain constant, an upward shift in the demand schedule will, in most cases, raise the going market price. On the other hand, price can affect demand. If the cost of supplying the item increases, or if, for some extrinsic reason, the price rises, the quantity demand will decrease. There has been no shift in the demand schedule. Buyers will still buy the same amount at any given price, but since the price has risen, the quantity demanded has been reduced.

We are accustomed to thinking of economics as simply a social science. In the economy idealized by Adam Smith, (The Wealth of Nations), our wants and desires are accurately reflected in the market by prices. In the real world, advertising, conditioning, and imperfect competition manipulate tastes and preferences, and prices. Our lifestyles dictate and are dictated by levels of industrialization, production, and consumption. What we may fail to realize is that environment is also an important determinant of supply and demand.

Dr. Harry Haakonsen of Southern Connecticut State College divides the environment into biotic, abiotic, and cultural factors. Biotic factors compose the living environment (animals, plants, bacteria); abiotic factors the non-living physical environment (energy, minerals, gases, water, etc). Cultural factors are the man-made environment which includes governments, institutions, technology, customs and religious arts and language. We are accustomed to thinking of prices as determined by cultural factors, but this activity will demonstrate the similar affect on the economic system of biotic and abiotic factors.

While students may have difficulty with the concepts of shifts in demand vs. changes in quantity demanded, they will probably see differences between exemplary cases 1, 3, 5, and 6, in which changing supply conditions cause price fluctuations leading to an opposite change in quantity demanded (e.g. case: the reduced supply raises the price, and fewer oranges are demanded) and cases 2, 4 in which changes in tastes and preferences alter the demand schedule, and price and quantity demanded move in the same direction (e.g. case 2: the discovery of the vitamin raises the demand schedule supporting sales of more oranges even at a higher price.)

The discussion questions are designed to illustrate that a product which is dependent upon climatic conditions for production will have a fluctuating price from season to season.

Before You Begin

Preparation: Ditto the Situations Sheet from this activity to supply one copy for each student group. Cut out the introductory statement. Cut out the six situations to make cards which will be distributed individually to groups. Each student will need a copy of the Worksheet provided here.

Words To Know

supply and demand, price, economy, biotic, abiotic, cultural

ACTIVITY

1. Divide the class into groups of 4 or 5 and distribute a worksheet to each student.
2. Distribute copies of the introductory statement to each group. Read it aloud to be sure students understand directions.
3. Distribute Situation Card #1 to each group, who will then discuss the situation and write down its prediction of how and why the price of oranges would be affected.
4. At intervals of about 7 minutes (depending on class time), distribute the remaining Situation Cards so that all groups will be able to discuss each situation.
5. Explain the meanings of vocabulary words abiotic, biotic, cultural when the groups have completed the activity, ask each student to title the 3rd column of the worksheet "Abiotic, Biotic, Cultural".
6. Ask each group to decide whether the cause of price fluctuation was an abiotic, biotic, or cultural factor change and to indicate responses on the worksheet. (Note: A price fluctuation can be caused by one or more factors.)
7. Conduct a class discussion utilizing the following questions:
 - a. In an economic system such as that of the U.S., is the price of oranges flexible or inflexible as different situations arise?
 - b. Do the group's predictions for the same situations differ from one another?
 - c. In each of the situations, how does consumer demand for oranges affect price?
 - d. What are some factors which influenced consumer demand for oranges? Which factors affect supply? Which factors affect demand?
 - e. What other products can you think of that have risen very sharply in price recently? What reasons can you give for these increases? (Some products that students might mention are beef, coffee, sugar, automobiles, gasoline).
 - f. Was it always easy to decide whether the price fluctuation was caused by abiotic, biotic, or cultural factor changes? Why or why not?

Related Activities

Assign for outside research:

1. How have changes in consumer demand for automobiles in the past fifty years altered the ways in which we use raw materials?

Resources

Stapp, W. and D. Cox, Environmental Education Activities Manual, 1974 pp. 43-44.

Further reading on demand, supply, and the distinction between shifts in demand and changes in quantity - demanded are in most economics texts. Recommended texts are:

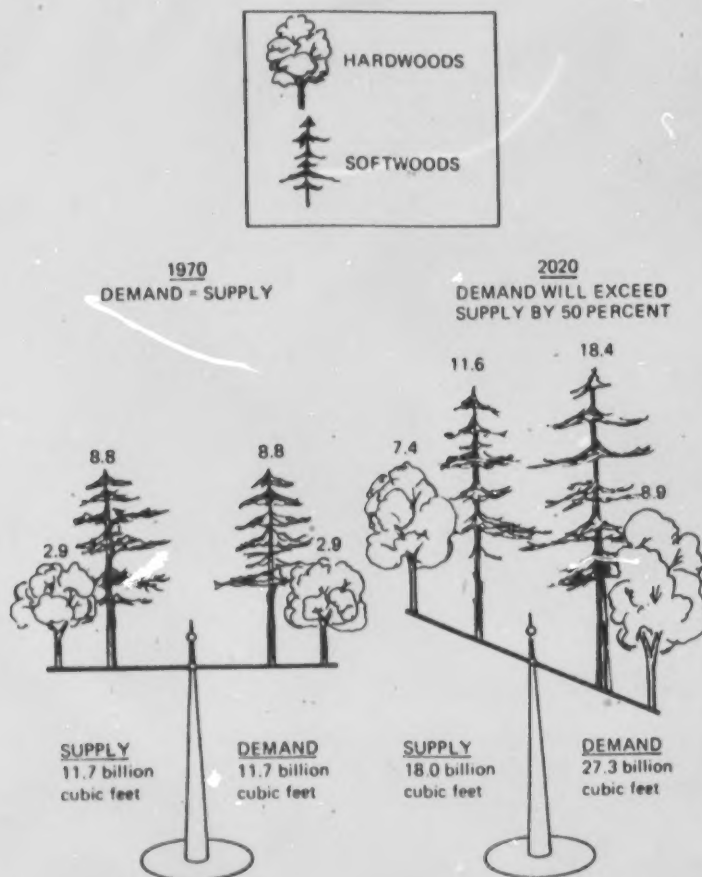
Samuelson, Paul A., Economics, 10th ed., McGraw-Hill, Ch. 4, 1975.

Lipsey, R. G. and P.O. Steiner, Economics, 4th ed.; Harper and Row, Ch. 5, 1975.

Haakonsen, Harry O., "Introduction to Ecology", Eco-Kit, E-P Education Services, 800 Dixwell Ave., New Haven, CT, 06511.

Notes To Myself

SUPPLY/DEMAND RELATIONSHIP FOR ROUNDWOOD PRODUCED FROM DOMESTIC TIMBERLANDS (BILLION CUBIC FEET)



STUDENT PAGE

SITUATION SHEET

Introductory Statement: Consumer demand for a product determines, to a large degree, the price of the product. Many factors influence the level of consumer demand, which in turn influence product price. Imagine that you are a member of the President's Council of Economic Advisers. Your task is to predict how the price and consumer demand for oranges will change in a variety of situations.

1

Insects cause a crop failure which strikes 2/3 of the country's orange groves.

2

Orange grove workers form a labor union and go on strike to protest poor wages and working conditions.

3

A Florida orange grower discovers that he can increase his crop yield four times by adding a newly-discovered fertilizer to the soil.

4

A team of medical researchers finds that oranges contain a unique vitamin which tends to prevent heart attack for people who eat more than two oranges a day.

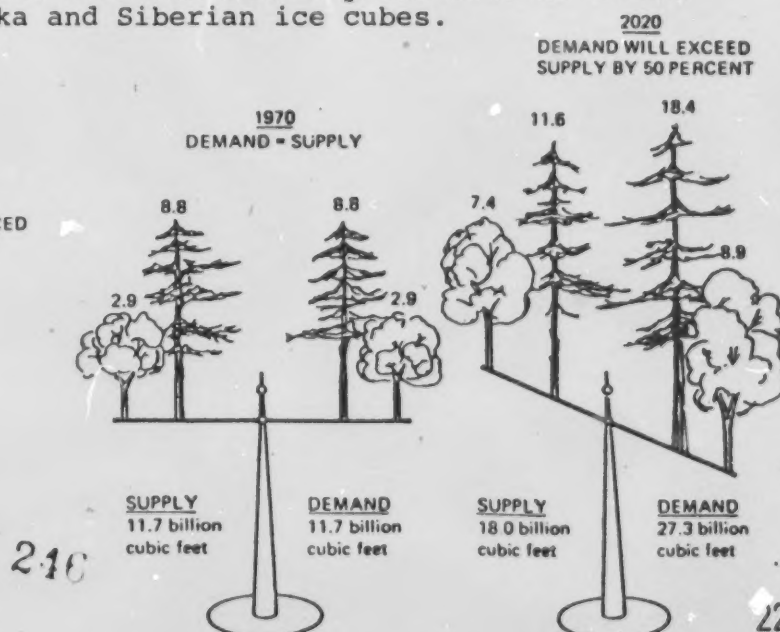
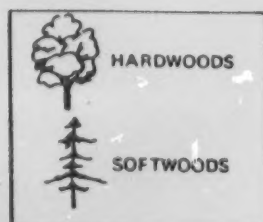
5

Someone invents an orange-flavored drink which contains the same amount of heart attack-preventing vitamin as contained in oranges, but is half the price of natural orange juice and tastes better.

6

The U.S. government signs a trade agreement with Russia whereby 3/4 of all oranges grown in the U.S. over the next 5 years will be traded to Russia in exchange for vodka and Siberian ice cubes.

SUPPLY/DEMAND RELATIONSHIP FOR ROUNDWOOD PRODUCED FROM DOMESTIC TIMBERLANDS (BILLION CUBIC FEET)



WORKSHEET

Situation	How Will Price Change?	Why Will Price Change?
1		
2		
3		
4		
5		
6	247	

Desalt of the Earth

Curriculum Topic

MATTER - physical properties
of solutions
CHEMISTRY

Subject

Science

Environmental Topic

ENERGY-RESOURCES

Grade Level(s)

4-8

Site

Classroom or Laboratory

Skills

Constructing models, con-
structing and testing
hypothesis

Author

Steve Gold

Objective

The student will be able to:

1. build a model desalinization plant powered by solar energy,
2. describe the process of distillation.

To The Teacher

Life on earth emerged in a watery medium, and is still entirely dependent upon this precious liquid. Though the earth's water resources are constantly flowing through the hydrological cycle, most of the planet's water is at any time, in the vast storehouse of the oceans. Less than 2% of the world's water is fresh, and more than 99% of the fresh water is ice. As water is used in greater and greater quantities, today 6,048 liters of it are used per person per day in the United States, pressure on supplies will increase because of pollution and depletion. The sea, a vast reservoir, may be mankind's water source of last resort.

The problem with seawater for human use is its salinity, which averages about 3.5% by weight. Such water cannot be used for drinking, would ruin cropland if used for irrigation, and would prove far too corrosive for most industrial uses. Removing the salt--desalinization--is essential if ocean water is to be used for human civilization.

Although a variety of desalting methods are being considered, distillation remains the oldest and simplest. Water is evaporated, leaving the salt as residue. The now-fresh water can recondense and is collected. This process goes on in nature all the time as water is evaporated from the ocean surface and recondenses in rain clouds.

Desalinization, for the moment, can at best supplement our fresh water resources. It currently provides less than .001% of the world's needs. Desalting on a massive scale is still far in the future. Two major problems with desalinization are the huge amounts of energy required for even a single desalinization plant, and the problem of what to do with the great amounts of salt residue. And although the amount of water in the oceans is immense compared to human needs, mere volume does not render the oceans invulnerable. Due regard must be shown for the health of the marine ecosystem. Desalinization is not a substitute for the wise preservation of clean, natural fresh water supplies.

This activity demonstrates the distillation process. It can be used to reinforce the understanding of solutions as physical, rather than chemical, combinations, and to instill concern for wise use of the compound which constitutes most of our bodies.

Before You Begin

Materials: Two or four students should work on each set-up.

wooden board, such as a large bread board; a sheet of aluminum foil large enough to cover the board; more aluminum foil sufficient for a trough; a rectangular pan of appropriate size, painted in advance with black enamel paint; sea water or salted tap water; two wire hangers or other stiff wire; large, clear plastic bags; a small beaker or measuring cup; scissors; a pebble, small rock, or other support, Student Page.

The activity should be conducted on a sunny day. If there is insufficient time to allow the students to observe the results, they could build the stills at any time and use them on the first sunny day. It is important that there be both enough sun and enough time for sufficient water to recondense. Of course, other things can be going on in the classroom while the water is being distilled.

Words To Know

distillation, solar energy, salt, saline, desalinization, evaporate, condense, solution

ACTIVITY

1. Ask the class to name the ways in which they use water. The list will soon become enormous, yet it might not include such uses as the making of everyday items (e.g. newspaper: water is needed to make paper from pulp.)
2. Ask if anyone ever uses ocean water for most of these purposes. Why not?
3. Explain that ocean water is a solution of salt in water. So is fresh water, but the ocean is much more salty. (That is, the percentage of salt is higher.) Have students re-define the word solution.
4. Explain that the class will build apparatus to collect fresh water from salty water.
5. Hand out the instruction sheets, answering any questions the class may have about them.
6. Have students construct the stills.
7. Have students set up their stills. About half should be in strong sunlight; the other half should be in shade. If natural shade is not available, you can, of course, create shaded areas. Allow the class to observe their stills for several minutes and record their observations. Then let the stills sit for a time as the distillation process continues.
8. When the allotted time has elapsed let each group record the amount of water collected in its beaker. Let students taste the difference between the fresh water collected and the saltwater in the pan. Average the results for the groups whose set-ups were in the sunlight and those whose stills were shaded.
9. Have students, during discussion or in writing, try to explain the difference between the two averages. The explanation should include a hypothesis about how the still works (based on observations) and about the source of energy for the machine. Leading questions might include:
 - a. Where does the water in your beaker come from? (The plastic bags.)
 - b. How did it get there? (By condensing from the air.)
 - c. How did it get into the air? (By evaporating from the water in the pan.)
 - d. Which groups collected more water - those whose setups were in the shade, or those who left their stills in the sun? (Sun)
 - e. Why? (The sun's rays provide the energy needed to evaporate the water.)
10. Lead further discussions in as much detail as you wish about water, desalinization, and pollution.

Related Activities

1. Perform the activity again, using graduated cylinders to carefully measure the amount of salt water placed in the pans. At the end of the activity, measure the amount of water left in the pan. Does the amount of fresh water collected plus the amount of salt water left in the pan equal the amount of water originally placed in the pan? Allow students to construct hypotheses to explain the difference.
2. Let one of the pans stay in the sunlight until the water is completely evaporated. Let students sample the salt residue.

Resources

- G. Tyler Miller, Jr. Living in the Environment; Wadsworth Publishing Company, 1975, Ch. 14, esp. pp. 259-260, EEC #B79 and
- A. Turk et al, Environmental Science; Saunders, 1974, Ch. 10, esp. pp. 404-405, EEC #B78, for general information about the water cycle and desalinization.

Credit

Directions for building the still come from:

"Build a Water Desalting Model:, Dolphin Log; The Cousteau Society, May/June 1978, page 2.

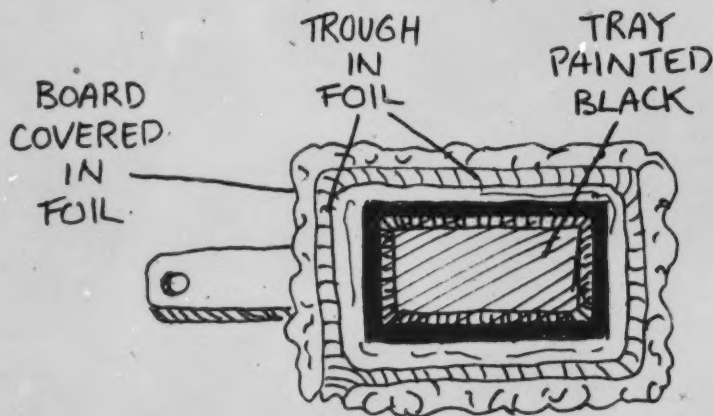
Notes To Myself

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STUDENT PAGE

BUILDING A DESALINIZATION MODEL

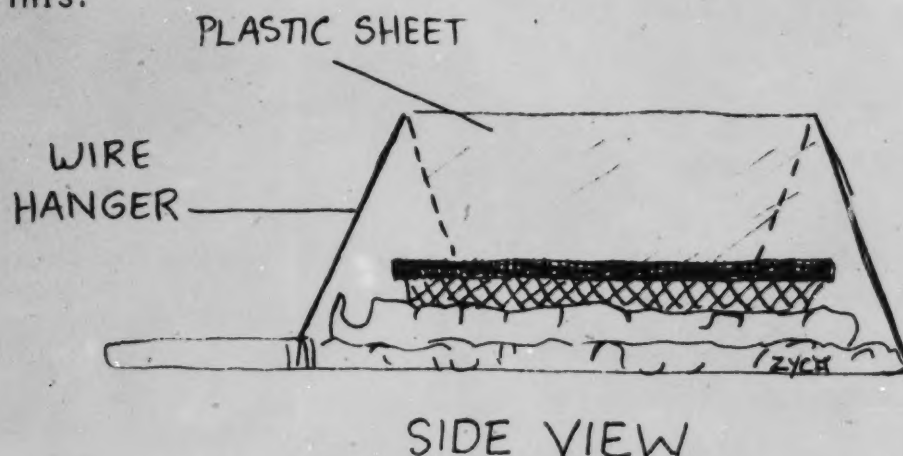
1. BE SURE YOU HAVE ALL THE THINGS YOU WILL NEED;
A WOODEN BOARD
TWO SHEETS OF FOIL
TWO WIRE HANGERS
SCISSORS
A PAN, PAINTED BLACK
LARGE PLASTIC BAGS
A MEASURING CUP
A SMALL ROCK
2. COVER THE WOODEN BOARD WITH A SHEET OF FOIL.
3. SHAPE A TROUGH AROUND THE INSIDE EDGES OF THE BOARD WITH YOUR OTHER SHEET OF ALUMINUM FOIL. BE SURE THAT THERE IS AN OUTLET IN ONE CORNER.
4. PLACE YOUR PAN NEXT TO THE TROUGH ON THE BOARD. WHEN YOU ARE FINISHED, YOUR MODEL SHOULD LOOK SOMETHING LIKE THIS:



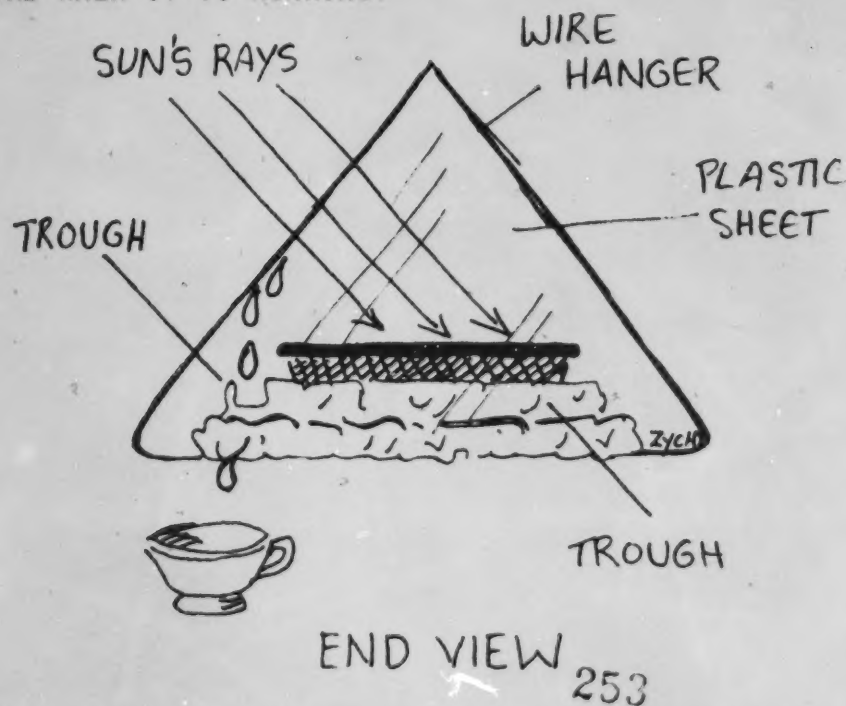
TOP VIEW

5. FILL THE PAN HALFWAY WITH THE SEAWATER OR SALTED TAP WATER YOUR TEACHER WILL GIVE YOU.
6. BEND TWO WIRE HANGERS OR OTHER STIFF WIRE TO MAKE A TRIANGULAR PRISM. MAKE SURE THAT THE SIDES OF THE PRISM FIT ON THE OUTSIDE OF THE BOARD.

7. CUT YOUR PLASTIC BAGS INTO SINGLE SHEETS. MAKE A SEE-THROUGH TENT BY USING THESE SHEETS TO COVER THE OUTSIDE OF THE WIRE PRISM.
8. PLACE THE PLASTIC WIRE TENT AROUND THE OUTSIDE EDGE OF THE TROUGH, LIKE THIS:



9. WHEN YOU ARE FINISHED, YOU WILL BE READY TO SET YOUR MODEL STILL TO WORK. PLACE IT IN STRONG SUNLIGHT OR IN THE SHADE, AS YOUR TEACHER DIRECTS. TILT IT WITH A SMALL ROCK SO THAT THE OUTLET OF THE TROUGH LEANS DOWNWARD. PLACE A CUP AT THE END OF THE OUTLET TO COLLECT YOUR FRESH WATER. HERE IS A VIEW OF WHAT YOUR MODEL MIGHT LOOK LIKE WHEN IT IS WORKING:



Build a Solar Heater

Curriculum Topic

ENERGY FORMS, ASTRONOMY

Subject

Science

Environmental Topic

ENERGY - RESOURCES

Grade Level(s)

6 - 8

Site

Classroom, laboratory

Skills

Constructing models
Observing
Making conclusions

Author

Ed Lisk

Objective

The student will be able to build a solar water heater and demonstrate its use.

To The Teacher

As the cost of fossil fuels rises rapidly, many people are turning to solar energy as a fuel source. Some day every home may have a solar heat collector on its roof.

A solar heat collector captures and holds solar radiation as heat until the heat can be removed for useful work. A dull, black-surfaced material of high specific heat absorbs radiation. After the radiation is absorbed, it must be transferred to a fluid that has the properties of easy movement and storage. In this case, heat is transferred from black surface, to water in the vacuum tubing, to storage in the gallon can. This stored hot fluid provides heat for home purposes.

Before You Begin

Scrap wood sufficient to build a box 33cm x 72cm x 8cm, 5 meters black vacuum tubing, 2 electrical Althread nipples (be certain nipples fit tubing), 1 sheet of tin or aluminum 16cm x 20cm, thumb tacks, 1 gallon can or jug, 4 nuts, 2 washers, string packing material, clear plastic, thermometer, pencils and graph paper

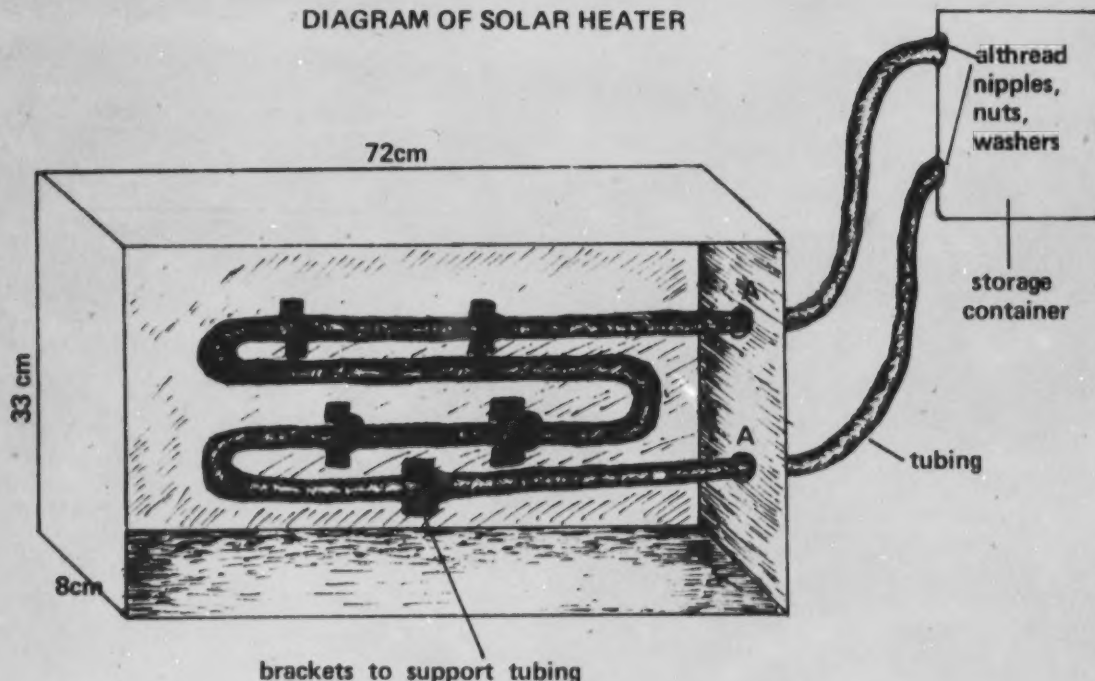
Words To Know

solar energy, heat, transfer, collector, absorber, radiation, conduction

ACTIVITY

A. Construction of solar heater

DIAGRAM OF SOLAR HEATER



1. Construct a box and paint flat black.
2. Cut 10 tin strips (4cm x 8cm) and paint black.
3. Drill holes in box at A.
4. Place and anchor tubing in box with black strips and tacks.
5. Put nipples in can or jug so tubing can be attached.
6. Fill system with all the water it will hold. Blow excess air out of tubing. Make top of box with clear plastic.

B. Using your collector

1. Measure temperature of water in the reservoir. Set solar box so it will receive maximum sunlight inside the box. Usually, the collector should be pointed south.
2. Measure temperature of water at intervals of 5 minutes.
3. Observe movement of water through the system. Move the system approximately every 20 minutes to maintain maximum sunlight efficiency.
4. Plot a graph of temperature and time.
5. Discuss the following questions:

a) What makes the water temperature rise? (Conversion of solar radiation - radiant energy - to heat energy.)

b) What causes the water to move? (Convection - hot rises and cold sinks.)

c) Why is everything inside the box black? (Black absorbs light energy best.)

d) Should the storage can be black? Why? (Yes, and it should be insulated to hold heat and encourage convection.)

e) What happens if you add more turns in the tubing or more tubing? (There is more area to catch sun, therefore the temperature rises.)

f) What happens if you tilt the heater a) away from the sun, and b) toward the sun? (a- Less direct sunlight results in lower temperature. b- More direct light results in higher temperature.)

g) Is there a maximum temperature which the heater can produce? (Yes, but this temperature can only be found by experimentation.)

h) What happens if you stand the heater on end? (The water will not flow.)

i) What happens if you color the liquid with food coloring? (The results depend on color of fluid and transparency of tubing.)

j) What happens if you paint the can black? (This increases the absorption and temperature of the stored fluid.)

k) What happens if you add reflectors to catch more light? (This increases the quantity of light which in turn increases the temperature.)

l) What methods of energy transfer does your solar heater demonstrate? (Sun to unit demonstrates radiation. Tube to fluid demonstrates conduction, and fluid movement demonstrates convection.)

Resources

National Solar Heating and Cooling Information Center, Rockville, Maryland

"Oklahoma Energy Awareness Education," Oklahoma State Department of Education, 1977 EEC #1355

Stoner, Carol H., Producing Your Own Power, 1975, p. 191

Credit

Illustration, Ann-Marie M. Fleming

Notes To Myself

Energy from the Sun

Curriculum Topic

ENERGY FORMS

Subject

Science

Environmental Topic

RESOURCES, ENERGY

Grade Level(s)

6 - 8

Skills

Locating and obtaining information,
listening

Site

Classroom

Author

Ed Lisk*

Objective

Students will be able to:

1. recognize the basic technology of solar collection and of the solar cell
2. deduce the benefits of solar energy sources

To The Teacher

The activity sheets in this activity introduce only two of the six technologies of solar energy being studied. To attempt to treat all six on two sheets would not be productive for most students. In addition, an understanding of all these methods demands a technological background that most of your students will lack. For your edification, a brief description of each one follows:

1. **Solar Heating and Cooling of Buildings.** This technology includes space heating, space cooling, and solar water heating. The illustration on the attached student page demonstrates one type of roof collector. One of the great advantages of this method is that each building can have its own collection system, independent of a municipal system. Though expensive to install, these systems have an almost negligible maintenance and operating cost.

The light of the sun passes through the layers of glass on the collector. This energy heats the black metal plate in which the pipes are embedded. The water that flows through these pipes is heated, and collected in a large tank in the basement of the house. In some systems, this water would then be circulated through the house as in conventional hot-water systems. In others, the hot water would be used to heat air, which would then be blown through ducts as in forced-air systems.

2. The second Student Page shows a sketch of a Photovoltaic Electric Power System, or solar cell. When light rays from the sun strike the thin silicon chips in a solar cell, an electric current is produced. The process requires no equipment that will wear out, does not pollute, and has unlimited life expectancy. The immediate obstacle to the widespread use of solar cells as an energy source is twofold: the energy-conversion efficiency of the cell is low-less than 20 per cent; and the cost of necessary technological development in order to mass produce the cells is extremely high.

3. **Solar Thermal Conversion.** This system consists of solar collectors and thermal storage devices delivering high-temperature thermal energy to a turbine power plant. A solar "farm" would be made up of many collectors with curved surfaces to concentrate the sun's rays and focus them at one point (the focal point) creating very high temperatures. The focal point may be a pipe containing water or some other liquid. The intense heat then turns the liquid into a gas, which will power a turbine.

4. **Wind Energy Conversion.** Wind energy is a secondary form of solar energy derived from heating of the earth by the sun.

5. **Bioconversion to Fuels.** The Bioconversion to Fuels (BCF) involves the capturing of the sun's energy by plants which may then be converted to clean, burnable fuels.

6. **Ocean Thermal Conversion power plants.** These plants will take solar-heated water from the upper level of the ocean and use this heat to turn a liquid with a low boiling point into a gas to drive a turbine. Then, cold water will be brought up from a lower ocean level via a pipe to condense the gas, and the process is repeated.

Before You Begin

duplicate student worksheet

Words To Know

solar collector, solar cell, conversion, storage, circulation

ACTIVITY

1. Have students complete the student worksheets.
2. Have students list all the component parts of the solar collector and solar cell.
3. Discuss where these energy froms are being used today in your community.
4. Follow with discussion questions:
 - (a) explain the added costs of using solar energy presently and the savings potential for the future.
 - (b) how would it change your life if you were totally dependent on solar energy?
 - (c) what are the indirect ways we use the sun's energy?

Related Activities

1. Build a solar collector.
2. Purchase solar cells and run a small appliance.
3. Have a "sun-only" day, a "sunless day".
4. Explore ozone layer problems and its relationship to solar energy.

Resources

Clark, Wilson, Energy for Survival, Anchor-Press, 1975. Turk, J., Witter, J., and A. Turk, Ecosystems, Energy, Population, 1975. Saunders Company, Portola Institute, Energy Primer, Fricke-Parks Press., Calif., 1978. "Energy Fact Sheet", National Science Teachers Assoc., Oak Ridge, Tenn., 1977.

Credit

*This activity based on: "The Energy Challenge", Federal Energy Administration, EEC #1012 (Worksheets from Activity #15 and #16)

ENERGY FROM THE SUN

Part I and II

Answers to student worksheet

Part I

1. South; southwest
2. the south side
3. to reflect and concentrate the rays of the sun
4. no
5. yes
6. technology; cost; setting research priorities

Part II

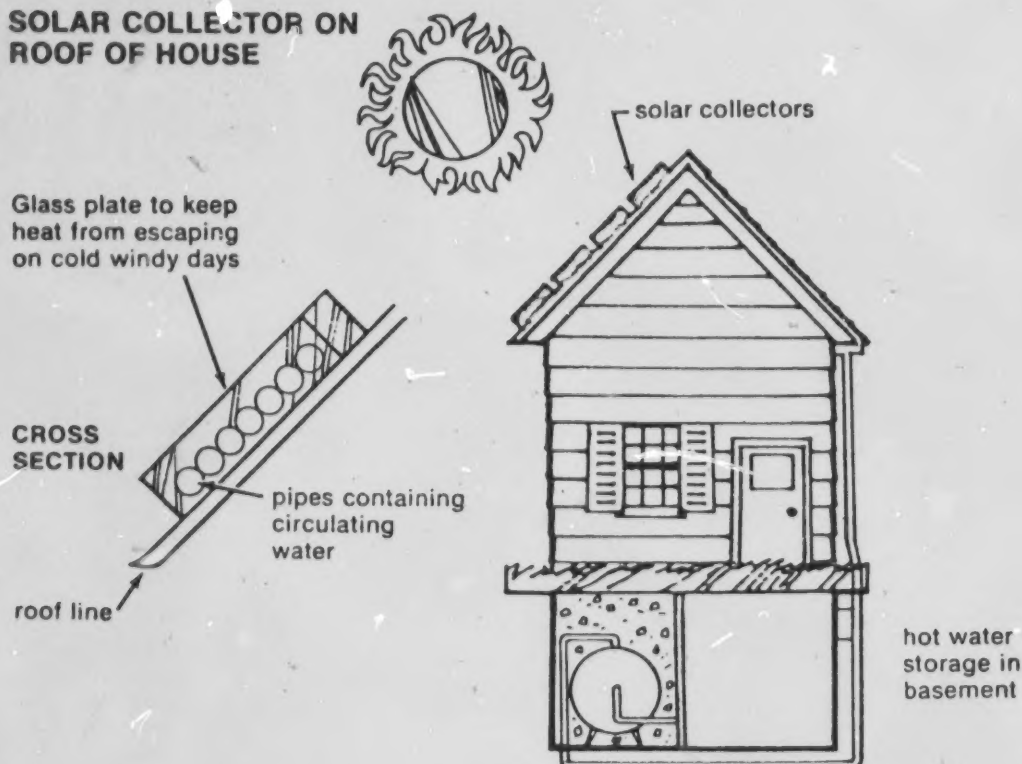
1. satellites
2. sand
3. number of bulbs times 100 times \$20.00
4. further develop technology and bring down cost
5. in storage batteries

STUDENT PAGE

Energy from the Sun (Part 1)

There are several ways to use solar (sun) energy. One way is for each house, apartment or office building to collect enough solar energy to take care of its own heating, air conditioning, and water heating, but not its electric power. Another is to build huge solar farms to collect solar energy, turn it into heat and then to electricity that will be sent to individual dwellings. A one-square mile farm of many of these collectors could supply electricity for about 20,000 houses.

SOLAR COLLECTOR ON ROOF OF HOUSE



1. What parts of the U.S. would be able to use solar heat without a conventional back-up furnace?

2. What side of the roof should the collectors be mounted on?

3. Why is the inside of some types of collectors lined with mirrors?

4. Will the heat from roof collectors be used to generate electricity?

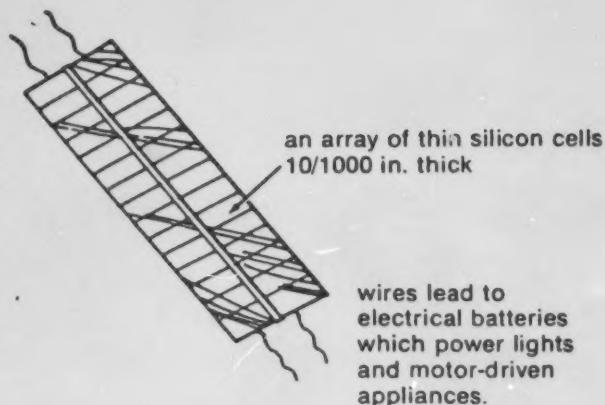
5. Could the heat from solar farm collectors be used to generate electricity?

6. The U.S. Energy Research and Development Administration foresees as much as 25 percent of our energy needs filled by solar technologies by the year 2020. Why will it take so long?

Energy from the Sun (Part 2)

SOLAR CELL

This device converts sunlight directly into electricity, with no moving parts and no pollution.



1. Solar cell systems are now used to power spaceships and _____
2. We probably will never run out of silicone as a resource because it is the second most plentiful substance on earth. Do you know its more common name? _____
3. If it now costs \$20 a watt to generate electricity by means of solar cells, how much would you have to spend on equipment to power just the 100 watt light bulbs in your house? _____
4. What do we need to do before we can use solar cells as an energy source? _____
5. How can electricity be stored to use later? _____

THE ADVANTAGES AND THE DISADVANTAGES OF SOLAR ENERGY

DISADVANTAGES

1. Expensive to install
2. Requires a great deal of space
3. The sun doesn't always shine
4. Would mean modification of housing in many cases
5. New laws would be needed concerning construction that might cast shadows

ADVANTAGES

(See if you can supply the advantages. What is good about solar energy in regard to each of the following?)

1. Supply. _____
2. Pollution. _____
3. Embargoes. _____
4. Cost. _____

Let's Power Spaceship Earth With the Sun

Curriculum Topic

ENERGY FORMS: SOLAR
EARTH SCIENCE
ASTRONOMY

Subject

Science

Environmental Topic

ENERGY RESOURCES

Grade Level(s)

6-8

Site

Classroom

Skills

Reading, locating and
obtaining information

Author

Ed Lisk*

Objective

Students will be able to:

1. recognize and cite the magnitude of the sun as an energy source
2. illustrate ways by which people throughout history have depended on the sun's heat and light.

To The Teacher

The sun, the great star of our astronomical system, is the source of almost limitless energy. The sun's energy is thermonuclear in origin. That is, the core of the sun is hot enough to bring about a nuclear reaction, in the course of which tremendous amounts of energy are released into space in the form of rays or waves of radiation. Visible light, heat, and radio waves pass through the earth's atmosphere in amounts appropriate to sustaining life on earth. The outer ozone layer of the atmosphere, which is created by the sun's action on oxygen molecules, is, for life on Earth, a protective layer against lethal solar radiation such as excess ultraviolet radiation.

You can demonstrate the rays of visible light waves by shining a beam of sunlight through a prism or even a drinking glass full of water. The seemingly yellow-white light will break up into rays of violet, blue, green, yellow, orange, and red. Remind students that they have seen these light rays in a rainbow.

The sun heats the land and the oceans and creates the great currents, the wind and the waves. It provides energy for evaporation, a step without which the Earth's carefully-modulated water cycle would be broken. Water that falls as rain feeds the rivers and the streams which turn water wheels and turbines of hydroelectric plants. Radiant energy is changed to stored chemical energy by the process of photosynthesis that takes place in the cells of green plants. It is this chemical, potential energy that is stored in coal, oil, and natural gas.

After completing the student pages of this activity, students will be able to understand our reliance on the energy of the sun in an historical context. Students identify items of a list as direct or indirect products of the sun's energy. Several discussion questions are included which are designed to urge the class to imagine a future life in which power will come from a major non-polluting, inexhaustible energy source. Ask students to consider that while solar energy as a major energy source is attractive, the cost of developing technology for implementing it is great.

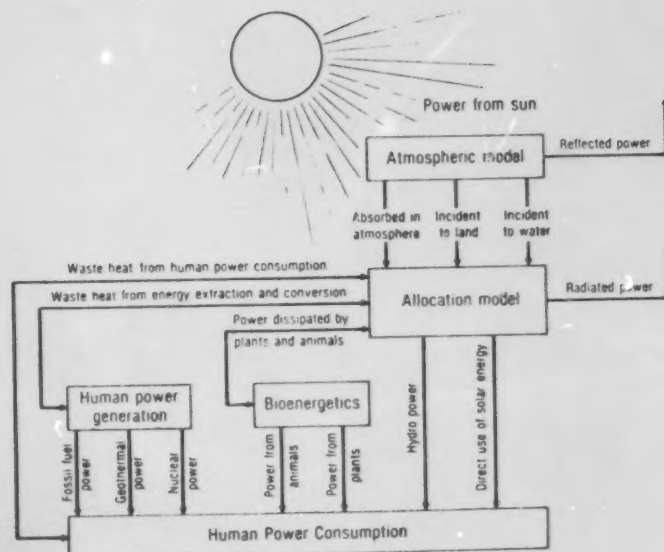
Before You Begin

Materials: copies of Student Pages

Words To Know

energy, generator, ozone, photosynthesis

Global Energy Model



ACTIVITY

1. Distribute Student Pages.
2. Ask students to read and complete the worksheets.
3. Discussion questions:
 - a. Why is the sun called the source of all but nuclear energy?
 - b. Imagine future life on earth when we have learned to harness the power of the sun to provide heat, light and electricity. What problems would be solved? What problems might be created?
 - c. Discuss the order of changes which would occur if the sun stopped shining.
 - d. Discuss the benefits provided to us by using more of the sun's energy directly.

Answers to Student Worksheet

<u>D</u>	coal deposits	<u>D</u>	sugar cane
<u>I</u>	sail boats	<u>I</u>	candy bar
<u>D</u>	salt flats	<u>I</u>	electric heater
<u>I</u>	gasoline	<u>D</u>	leaves turning green
<u>D</u>	photosynthesis	<u>D</u>	ocean currents
<u>D</u>	mountain streams	<u>I</u>	steam engine
<u>I</u>	Hoover Dam	<u>D</u>	ozone layer of the atmosphere

Related Activities

1. Build a solar collector.
2. Take a survey among the class to determine the forms of energy source used to heat their homes.
3. List all the different forms of energy individual students use in one day.

Resources

Clark, Wilson, Energy for Survival, Anchor-Press, 1975.

Turk, J., et al, Ecosystems, Energy, Population; 1975, Saunders Company.

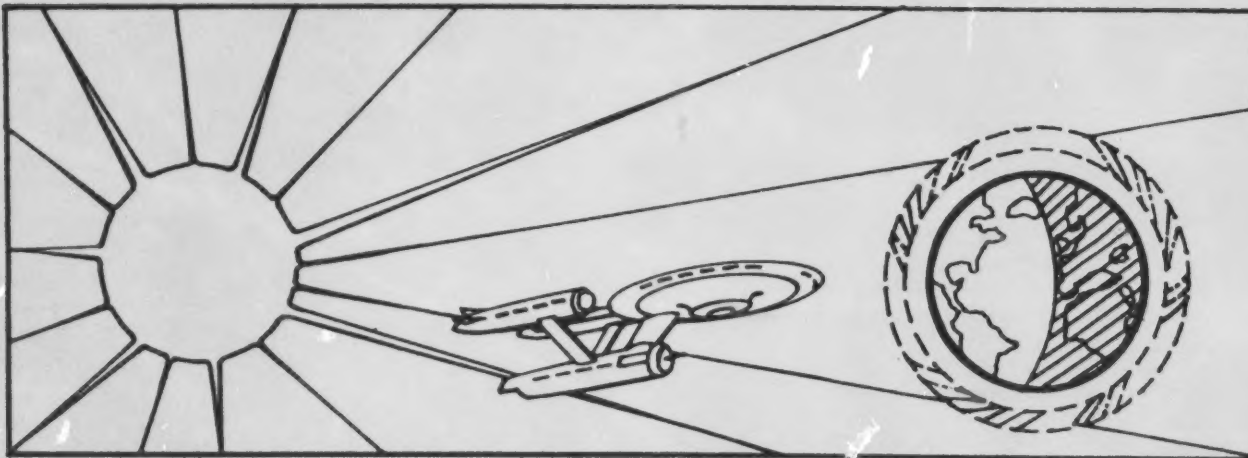
Energy Primer, Portola Institute; Fricke-Parks Press, 1974.

"Fact Sheet", National Science Teachers Assoc., Oak Ridge, TN, 1977.

Credit

*This is largely excerpted from "The Energy Challenge", U.S. Dept. of Energy, Worksheets from Activity #12, 1976, EEC #1012.

STUDENT PAGE



Let's Power Spaceship Earth With the Sun

The sun, 93 million miles away from earth, sends more radiant energy toward us every second than people have used in the course of human history. Thirty percent of this energy is reflected back into space by our atmosphere. Much of the remaining radiant energy of the sun heats the land and the water; it evaporates water and melts the snows. It is the source of energy that creates the winds and great ocean currents, and it warms the atmosphere that surrounds us.

Energy from the sun interacts with oxygen at the top of the earth's atmosphere to create a layer of ozone that protects us from lethal amounts of the sun's radiation. Solar energy reacts with plants in the chemical process of photosynthesis to provide the stored energy that fuels life. Coal and oil and natural gas, once swamp jungles of the ancient earth, are stored solar energy. All of these are ways we benefit from the sun's energy directly.

We also benefit indirectly from the sun's energy when that energy comes to us "secondhand." The electricity generated by a windmill, for example, is the sun's energy once removed. So, too, is the energy our bodies get from the food we eat.

Less than one percent of the incoming solar energy is used to sustain plant and animal life, yet this amount is many times greater than the total electric generating capacity of the entire world. The sun could be an important answer to our energy dilemma. All we have to do is find the key to the bank.

Humans from the dawn of history have put the energy from the sun to work to keep warm or to grow food, or by harnessing the wind. In what ways did early people use the sun to do work for them?

What has the energy from the sun made possible in your life today?

Put a D beside each of the following things that result from energy received directly from the sun. Put an I beside each thing that results indirectly from the sun's energy.

- coal deposits
- sailboats
- salt flats
- gasoline
- photosynthesis
- mountain streams
- Hoover Dam

- sugar cane
- candy bar
- electric heater
- leaves turning green
- ocean currents
- steam engine
- ozone layer of the atmosphere

New Energy Resources

Curriculum Topic

ENERGY FORMS, ENERGY GENERAL

Subject

Science

Environmental Topic

ENERGY RESOURCES

Grade Level(s)

6-8

Site

Classroom

Skills

Reading, writing, evaluating
information

Author

Ed Lisk*

Objective

The students will be able to:

1. identify and contrast the benefits and problems of eight new energy resources.

To The Teacher

The availability of energy resources has become a concern in the United States. The continuation of life as we know it, of progress, growth and a comfortable standard of living, depends on ever increasing quantity of energy. We now face the very real problem of limited supplies of fossil fuels, possible energy-related environmental damage, and high cost of developing alternative energy sources.

We have used our inventive genius to produce high-powered vehicles to transport our freight. We have devised heating and air-conditioning systems to keep our buildings warm in winter and cool in summer. Our food is mass-produced, processed, and packaged. We are cared for and entertained from the cradle to the grave by a steady stream of energy-consuming, labor-saving devices. And we have used our fossil fuels as if they might last us forever. We now need to increase our efforts to convert coal, our most abundant fossil fuel resource, to a more convenient and cleaner form of energy. We need to begin to act with some urgency in researching and developing other energy resources. And we need to reconsider our energy-consuming lifestyle.

An understanding of how our past energy supply and consumption has contributed to our present energy problems can help students approach the energy challenge of the future with greater respect and enthusiasm. They will see the need for other sources of energy and begin to understand the role that these alternative forms of energy might play in our future.

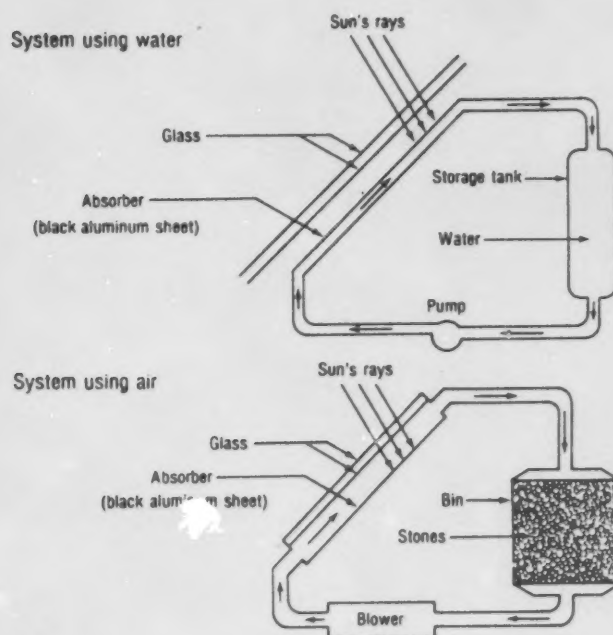
Before You Begin

Preparation: Reproduce and distribute the Student Worksheets. Make information on energy sources available to the students.

Words To Know

geothermal, gasification, liquefaction, pyrolysis, fossil fuel

Active Solar Space Heating Systems



The flow of water or stream of air carries the heat from the solar-radiation collector to the storage system (a water-filled tank or a bin filled with stones) or delivers it directly by conventional means (radiators or forced hot air) to rooms of the house.

Source: William A. Shurcliff, "Active-Type Solar Heating Systems for Houses: A Technology in Ferment," *Bulletin of the Atomic Scientists* 32(2):22 (1976).

ACTIVITY

1. Have students read the first Student Page.
2. Have students fill in the Problems/Solutions Page.
3. After completing the sheet you may want to pose the following questions:
 - a. What energy sources have the fewest problems and the most benefits.
 - b. Which energy sources might fill our energy needs of the future?
 - c. Which sources seem more likely to work than others?
 - d. List in order of importance the energy sources from most helpful to least.

Related Activities

1. Have students search newspapers and magazines for information on the issue of nuclear power. Some students can look for pro aspects and other students the con.
2. Build a solar collector or oven.
3. Explore how different parts of the country or world are using new energy forms. This could be from recent periodicals and newspapers.

Resources

Clark, Wilson, Energy for Survival, Anchor-Press, 1975

Energy Primer, Portola Institute, Fricke-Parks Press, California, 1974.

"Energy Facts Sheet", National Science Teachers Assoc. Oak Ridge, TN, 1977.

Turk, J., J. Wittes, R. Wittes, A. Turk, Ecosystems, Energy, Population, Saunders Company, 1975.

Credit

"This activity was largely excerpted from "The Energy Challenge", Worksheets from Activity #15 and #16 U.S. Dept. of Energy, 1976, EEC #1012.

Other New Energy Resources

Besides nuclear and solar energy, there are several other possibilities for the future. Read about some of these new energy sources on this page. Problems and solutions are associated with each of them. On the next page you will decide what some of these problems and solutions are.



WIND. Wind is actually a form of solar energy since it is caused by variations in the temperature of the air heated by the sun that causes air to move. Sailors used this energy for ages.

For many years farms have used windmills to generate electricity. Maybe giant windmills will someday be able to provide electricity for entire towns. The major difficulties are that the wind doesn't blow all the time and that practical storage systems are still being developed.



GEOHERMAL. The earth's center is a molten mass. In some areas this mass is close to the surface. Some evidence of this are volcanos, geysers, and hot springs. This heat can be trapped and used to generate electricity to supply cities without polluting the atmosphere. The problem is that this energy can now be tapped only where it is near the surface. Scientists are searching for other areas where this geothermal energy can be reached, but they don't have all the answers yet.



PYROLYSIS OF SOLID WASTE. It is possible to heat waste in an oxygen-free atmosphere and produce oil and gaseous products. This waste is what we're now having trouble removing from our environment:

manure, garbage, paper, logging residue, some industrial waste, sewage, and the like. The difficulty is that this material tends to be scattered in small amounts at various sites. The problem is one of gathering it together at a reasonable cost.



COAL GASIFICATION. By using high temperature and pressure, coal can be converted into a gas very much like natural gas. Building these conversion plants

near coal fields can solve the problem of transporting bulky fuel that gives off pollutants when it is burned. When coal gas is burned, it burns as cleanly as natural gas, causing virtually no air pollution. The usual pollution problems occur in the coal mining process, however, as they always have. The conversion process itself, however, uses large amounts of electrical energy.



COAL LIQUEFACTION. Although the technology is not completely developed, coal can be converted to an oil-like liquid. It has the advantage over coal gas of being usable to make all the usual

oil products, including a kind of gasoline to run our cars.



OIL SHALE. Oil shale is a rock containing a material that yields oil when it is crushed and heated. One ton of rock will produce about 25 gallons of oil. Most oil shale deposits are in the West. The rock must

be mined, either by deep mining or surface mining. Extracting the oil takes large amounts of water — three barrels to every one barrel of oil processed. One of the big problems is the disposal of the spent rock after the oil is extracted. Vegetation will not grow on the used shale without a moderate amount of rain — scarce in many parts of the West. Without vegetation, some animals may lose their homes and natural food supply. Rain water passing through this rock will possibly pick up pollutants and carry them to larger bodies of water if there is no vegetation. In addition, oil shale processing contributes to air pollution.

Problems/Solutions

In this unit, you have learned about eight new energy resources. The use of any one of these resources may help to supply our energy requirements but may at the same time present us with new problems to consider. In the lefthand column of this page are some of these issues — some are problems, some are solutions. Mark each statement S (for solution) or P (for problem). Place a checkmark in every energy-resource column on the right to which a statement applies. The first one is done for you.

IF THIS ENERGY SOURCE IS USED, IT . . .	SOLAR 	NUCLEAR 	WIND 	GEO-THERMAL 	COAL GASIFICATION 	COAL LIQUEFACTION 	OIL SHALE 	PYROLYSIS 
WOULD HELP SOLVE THE PROBLEM OF SOLID WASTE DISPOSAL.	✓		✓	✓	✓	✓		✓
COULD POLLUTE WATER.								
WOULD CONSERVE THE DWINDLING RESERVES OF FOSSIL FUELS.								
COULD DAMAGE WILDLIFE OR THEIR HABITAT.								
WOULD BE DIFFICULT TO STORE AND TRANSPORT.								
WOULD NOT POLLUTE THE ATMOSPHERE.								
WOULD DISRUPT THE NATURAL USE OF LAND SURFACES.								
WOULD NOT BE ABLE TO SUPPLY ENERGY ALL THE TIME.								
WOULD HAVE TO WAIT UNTIL THE TECHNOLOGY IS DEVELOPED.								
WOULD USE LOTS OF WATER TO PROCESS.								
WILL DECREASE THE NEED FOR OIL IMPORTS.								
WILL MAKE LARGE AMOUNTS OF WASTE MATERIAL.								
WILL MAKE USE OF THIS COUNTRY'S MOST ABUNDANT FOSSIL FUEL.								

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Energy Conversion

Curriculum Topic

ENERGY FORMS

Subject

Science

Environmental Topic

ENERGY - RESOURCES

Grade Level(s)

8

Skills

Reading, analyzing

Site

Classroom

Author

Ed Lisk

Objective

The student will be able to:

1. recognize and cite examples of energy conversions, using everyday things around them.

To The Teacher

Energy constantly changes forms. It can be potential energy stored in coal. Then as coal burns at a power plant the energy is changed to its kinetic form, the heat of steam. When the steam is allowed to strike the blades of a turbine, some of the heat energy becomes the kinetic energy of motion (mechanical) to turn the turbine. The turbine turns an electric generator and thus the mechanical energy becomes electrical energy. This electric energy is then available for conversion into other forms (light, sound, etc.)

These changes in the form of energy are governed by strict laws. The First Law of Thermodynamics states that energy can neither be created nor destroyed. The Second Law of Thermodynamics states that in any conversion of energy from one form to another some of the energy becomes unavailable for use. This means that in any energy conversion some of the energy becomes heat which can be lost to the atmosphere. In other words, this unusable heat energy leaks away. It is important to realize that escaped heat caused by inefficient conversions is one of the major causes of energy waste in our society.

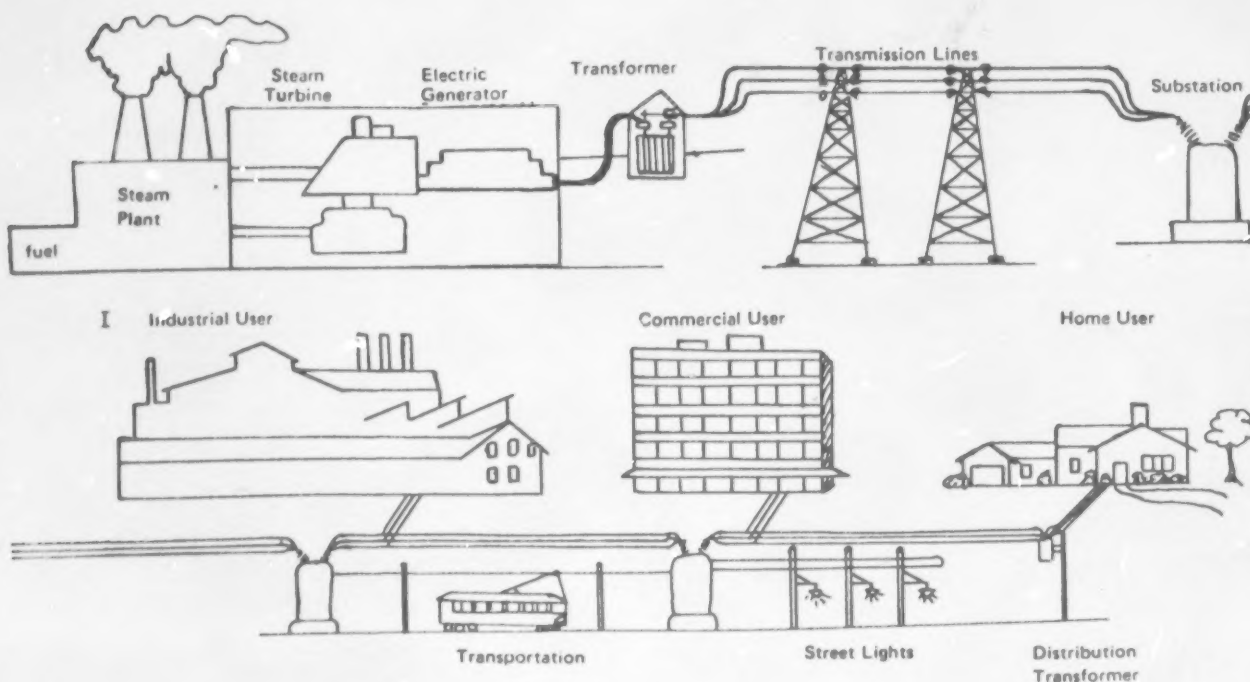
It is possible to convert all of mechanical energy to heat by, for instance, putting on the brakes of a car. It is possible to convert all the chemical energy of coal into heat by burning it. Since these conversions are not entirely reversible only a limited amount of heat energy is convertible to useful forms. There are many forms of energy but before most energy can be used to do work in our technological society it first must be changed into mechanical energy. These necessary energy conversions also result in energy lost.

Before You Begin

Duplicate student worksheet page.

Words To Know

chemical energy, mechanical energy, nuclear energy, Laws of Thermodynamics



ACTIVITY

1. Have the students complete the energy transformation chart of the student page. (included is answer sheet as teacher guide)
2. Have the students discuss their answers.
3. Have the students consider these questions:
 - a. Which energy conversions cause the most environmental damage?
 - b. Which energy conversions are the most efficient?
 - c. Determine which conversion is the most important to you as a student today.
 - d. List all the energy conversion taking place in the classroom.

Related Activities

1. Make a model of a steam turbine.
2. Tour a local power plant.
3. Have class do heat "gain and loss experiments" to prove heat conversions do take place.

Resources

Clark, Wilson, Energy for Survival, Anchor Books, Garden City, New York, 1975.

Energy Primer, Portola Institute, Fricke-Parks Press, Fremont, CA 1974.

Credit

This activity based on "Energy, Engines, and the Industrial Revolution" a unit developed by the National Science Teachers Association for U.S. Department of Energy, 1977. (EDM-1032)

Notes To Myself

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STUDENT PAGE

Evaluation Sheet

Directions: Write in each box examples of one form of energy being converted into another form. Begin with the vertical column on the left. Example: Heat is converted into light energy in a light bulb, so write "light bulb" in the box formed by the intersection of the two energy forms.

	HEAT	LIGHT	SOUND	MECHANICAL (Movement)	CHEMICAL	ELECTRIC	NUCLEAR
HEAT							
LIGHT							
SOUND							
MECHANICAL (Movement)							
CHEMICAL							
ELECTRIC							
NUCLEAR							

Evaluation Sheet

Directions: Write in each box examples of one form of energy being converted into another form. Begin with the vertical column on the left. Example: Heat is converted into light energy in a light bulb, so write "light bulb" in the box formed by the intersection of the two energy forms.

	HEAT	LIGHT	SOUND	MECHANICAL (Movement)	CHEMICAL	ELECTRIC	NUCLEAR
HEAT		light bulb fire electric arc	explosions	steam turbine	disassociation of water or other molecules	thermionic effects	nuclear reactions in stars
LIGHT	infra red absorption			light pressure photoelectric effect	photosynthesis other photo- chemical reactions	solar cell, other photo- voltaic effects	
SOUND	sound eventually dissipates as heat	sound con- verted to mod- ification of laser beam		sound is a mechanical motion of molecules		microphones, telephones	
MECHANICAL (Movement)	rubbing hands, friction in general	non-electical sparks	vocal cords, musical instruments			electric generator	cyclotrons & other high en- ergy machines
CHEMICAL	gas furnaces, fuels in general	fuel burning, fire-fly pho- sphorescence	firecrackers, other explosives			fuel cell battery	
ELECTRIC	incandescent light, iron, cooking	fluorescent light, television	telephone speakers, radio, etc.	motor	charging storage battery		
NUCLEAR	nuclear reactor, fus- ion reaction	nuclear bomb	nuclear bomb	nuclear bomb		"nuclear batteries"	

They're In Hot Water

Curriculum Topic

ENERGY - heat
BIOLOGY - cells, plants & animals

Subject

Science, Chemistry

Environmental Topic

ENERGY - RESOURCES

Grade Level(s)

8

Site

Laboratory

Skills

Data skills, collecting
and compiling, interpreting
inferring

Author

Pat Perrella

Objective

Students will be able to:

1. explain that living things use up more dissolved oxygen when the temperature increases from increased metabolic activity and
2. explain how increasing the temperature of water decreases the amount of dissolved O_2 .

To The Teacher

Any transfer or conversion of energy is, in part, inefficient. Useful energy is degraded to useless energy which is dissipated from the energy-using system to the environment as heat. Even the simplest human activities, such as hammering a nail, transfer energy releasing some as heat.

While the total amount of heat generated by human activities is slight compared to the heat of the sun absorbed by the earth, excessive heat discharges at particular sites can often cause local climatic and ecologic changes. This is especially true when we dispose of our waste energy by heating water instead of air, as water has a much higher heat capacity per unit volume. For example,

"A one-million-watt [electrical generating] facility, running at 40 percent efficiency, would heat 30 million gallons of water by 8.5 Celsius degrees (15 Fahrenheit degrees) every hour. A one-million-watt nuclear plant, operating at about 32 percent efficiency, would require 50 million gallons of coolant water every hour to extract the same quantity of heat. It is not surprising that such large quantities of heat, added to aquatic systems, cause ecological disruptions. The term thermal pollution has been used to describe these heat effects.

The processes of life involve chemical reactions and the rates of chemical reactions are very sensitive to changes in temperature. As a rough approximation, the rate of a chemical reaction doubles for every rise in temperature of 10 Celsius degrees (18 Fahrenheit degrees). We know that if our own body temperature rises by as much as 5°C (or 9°F, which would make a body temperature of $98.6 + 9 = 107.6^{\circ}\text{F}$) the fever may be fatal."

We, fortunately, are endotherms. This means that, like other mammals, we have internal mechanisms for temperature control. With the exception of the aquatic mammals and birds, all water-dwelling species are ectotherms. Their body temperatures conform to the temperature in the surrounding environment. When

"a fish responds to temperature increase, all its body processes (its metabolism) speed up, and its need for oxygen and its rate of respiration therefore rise. The increased need for oxygen is especially serious since hot water has a smaller capacity for holding dissolved oxygen than cold water. Above some maximum tolerable temperature, death occurs from failure of the nervous system, the respiratory system, or essential cell processes. The brook trout, for example, swims more rapidly and becomes generally more active as the temperature rises from 40° to 48°F. In the range from 49° to 60°F, however, activity and swimming speed decrease, with a consequent decline in the trout's ability to catch the minnows on which it feeds. This inactivity is more critical because the trout needs more food to maintain its higher metabolic rate in the warmer water. Outright death occurs at about 77°F"

Temperature changes which adversely affect any organism in the food chain (fish or not) have wide consequences upon an ecosystem.

The most important concept for students to understand in this activity is that at the very time organisms need the most dissolved oxygen it is least available. During the experiment, students should find that oxygen is used up faster by the yeast in the warm test tube. The warm test tube should become colorless in 6-8 minutes, while the tube at room-temperature takes 12-15 minutes. This indicates that increasing temperature increases metabolic activity and oxygen demand. In number seven of the discussion questions on the student worksheet, yeast and a fish living in its natural environment are brought into comparison. Since both carry out the same life processes, the assumption in question seven should seem reasonable.

Before You Begin

Materials: Make available to each pair of students: 1/2 tsp. dry yeast, 1/2 tsp. powdered milk, 1 dropper bottle methylene blue, 2-10 ml graduate cylinders, 3 test tubes, 1 test tube rack, thermometer, stirring rod, plastic spoon, 250 ml beaker, alcohol burner and stand, 2 small beakers (50 or 100 ml) clock, marking pencil

Students will need to have some background information:

- a. Discuss with them heat (thermal) pollution and its sources.
- b. Explain that methylene blue is an indicator which becomes colorless as oxygen is used up. Yeast are single-celled plants which use O_2 and sugar (in the powdered milk) to produce energy with the release of CO_2 and alcohol.

When most of the methylene blue in tubes 1 and 2 changed, a ring of methylene blue remains at the surface of the liquids. This is because oxygen from the air dissolves in the upper layer of the mixtures. Don't offer this explanation too soon! Let students think it out.

Caution: Clean glassware is essential to the success of this experiment.

Words To Know

metabolism, thermal pollution, decolorization, solubility

"THE WATER'S COLD, MOM!"

Conservation News



ACTIVITY

1. Provide each student with a "Record Sheet" and "Directions for the Experiment" as included here.
2. Instruct them to perform the experiment and to follow it up by answering the questions on the "Student Record Sheet."
3. Discuss these answers in class.

Related Activities

1. Experiment to show that the solubility of CO_2 also decreases as water temperature increases. This increase affects plant life.
2. In these days of energy crisis, it is strange to think of "waste heat". Yet the 30-40% efficiencies given for the production of electric power are about the best we can do. Discuss ways to conserve energy and reduce thermal pollution by using this waste heat. Possibilities are: aquaculture, home heating, greenhouse heating, irrigation providing steam for industrial users.
3. Discuss ways to reduce thermal pollution: cooling towers, new "dry" cooling towers, improvements in efficiency such as magnetohydrodynamics (MHD), cooling ponds, use of solar cells (which add more heat than the sun provides naturally).

Resources

Cunningham, J., Biology, You and Your Environment, P.C. Heath & Co., 1976, pp. 62-64.

Environmental Science Probing the Natural World, Intermediate Science Curriculum Study; Silver Burdett Co., 1972, pp. 23-26.

Credit

Large parts of "To The Teacher", as well as the last two related activities, are from: Turk, A., et al, Environmental Science, W. B. Saunders, 1974, pp. 198-208. (quotations are from pp. 198, 199)

Notes To Myself

STUDENT PAGE

Directions to the student:

1. Heat a 250 ml beaker half-filled with water until the water temperature reaches 40°C. While the water is heating, go on to the next step, but don't forget to keep your eye on the thermometer!
2. Make some milk by adding 1/2 tsp. powdered milk to 20 ml water in a small beaker. Mix it well.
3. Make a yeast mixture by adding 1/2 tsp. dry yeast to 10 ml water in another small beaker. Mix it well.
4. Mark 3 test tubes 1, 2, and 3. Place them in the test tube rack. The following table tells you what substances to put into the 3 test tubes. Be sure to use a rinsed graduate cylinder each time you change substances. Mix well.

Test Tube		Methylene Blue	Yeast Mixture
1	3 ml milk	20 drops	20 ml
2	3 ml milk	20 drops	20 ml
3	5 ml water	20 drops	-----

5. Quickly put test tubes 2 and 3 into the beaker of warm water and record the time in Table 1 on your Record Sheet. Observe the 3 test tubes carefully and watch for the color to disappear (decolorization). If it occurs record the time it took in Table 1.

STUDENT RECORD SHEET

Table 1 Results of Experiment

Test Tube	Temp. °C	Starting Time	Time for Decolorization	Total Time for Decolorization (min)
1				
2				
3				

Answer the following questions in complete sentences:

1. What does the decolorization in the test tubes show?
2. For what is milk used in this experiment?
3. Did increasing the temperature of the water have an affect on the rate at which oxygen was used by the yeast? If so, what was the effect?
4. If the rate at which oxygen was used was increased by heating, what must have been happening to the rate of the chemical changes (metabolism) in the yeasts' bodies?
5. You should have observed a ring of methylene blue that stayed at the top of the liquids in test tubes 1 and 2. Why did the methylene blue near the surface not become colorless?
6. What purpose did test tube #3 serve in this experiment?
7. Do you think it is reasonable to assume that a fish would use more dissolved oxygen if the temperature of its environment were increased? Why or why not?
8. You have found that living organisms use more dissolved oxygen when the temperature increases. This could account for the more rapid color change in warm water containing yeast. Look at Table 2 and see if you can determine another possible explanation for the faster color change in the warm test tube.

Table 2 ~ Temperature and Solubility of Oxygen

Temperature °C	Amount of Oxygen Gas That Will Dissolve in Water (g/100 ml)
0	0.0069
10	0.0054
20	0.0043
30	0.0036
40	0.0031
50	0.0027
60	0.0023
70	0.0019
80	0.0014
90	0.0008
100	0.0000

9. If an aquatic animal was very active and needed a lot of oxygen, would you expect to find this animal living in cold or warm water? Explain your answer.
10. What do you think would happen to the activity of this aquatic animal if its environment were changed by thermal pollution?

Wind Meter

Curriculum Topic

METEOROLOGY

Subject

Science

Environmental Topic

ENERGY-RESOURCES

Grade Level(s)

4 - 8

Site

Classroom or Family Car

Skills

Construction, measuring,
implementing, evaluating
information

Author

Carla McGeeney

Objective

The students will be able to:

1. describe steps in the construction of an anemometer,
2. be able to roughly calculate the speed of the wind,
3. list some ways and uses for harnessing wind energy,
4. locate the windiest area of their school (windward side).

To The Teacher

Ecosystems include not only the living (biotic) system, but the non-living or abiotic environment, such as weather as well.

The amount of rain and wind in an area determines what kind of vegetation can exist there. It also determines the wind-chill factor which we interpret at a comfort level.

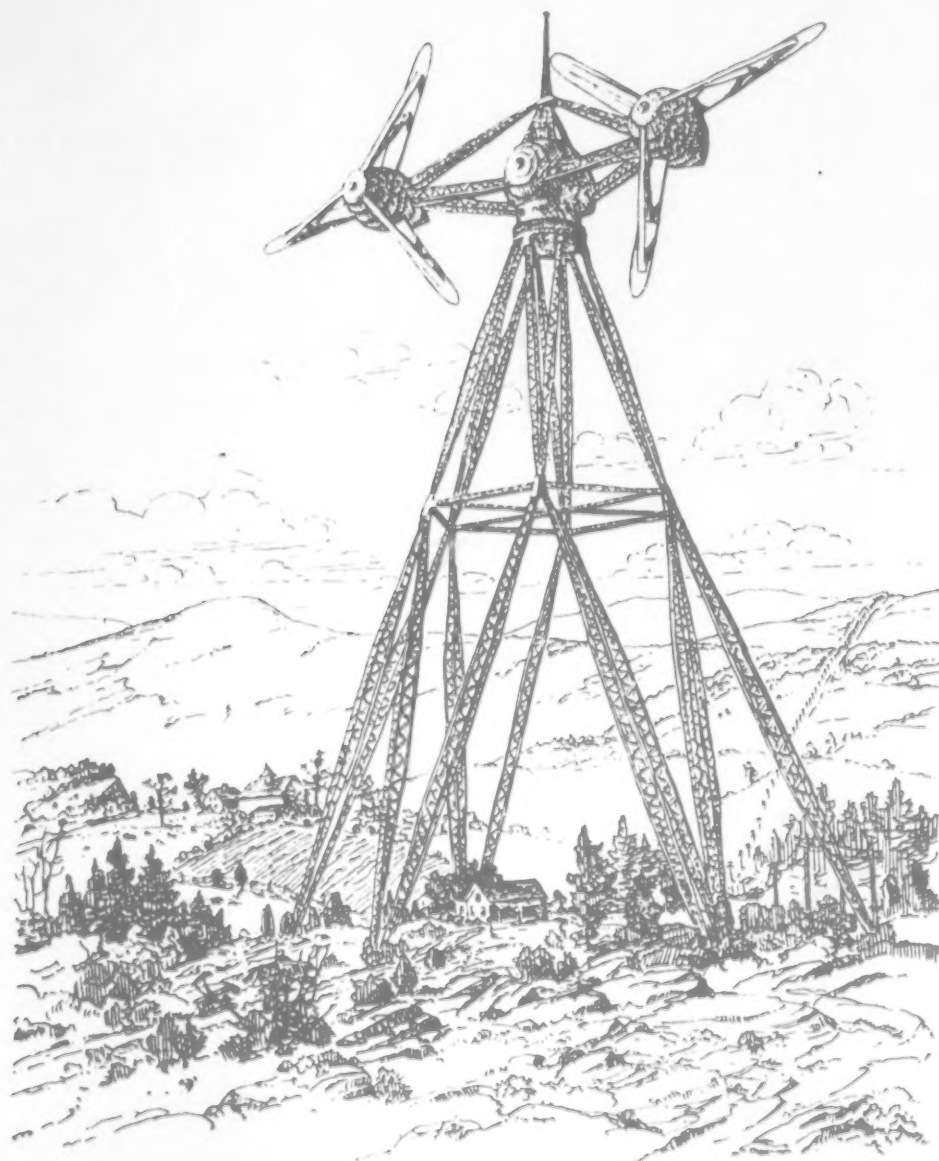
By constructing and using an anemometer, students will acquire some feeling for wind speed and its impact in an ecosystem. Areas of higher wind speed such as a waterfront, high elevation or island can be suitable sites for harnessing wind energy. To run an economically efficient windmill, there needs to be an average wind velocity of 15 mph (at oil costs of \$10-\$11 per barrel).

Before You Begin

Materials: plastic, transparent soda straw; single edge razor blade; very small styrofoam ball (to fit inside straw), 3 pieces of stiff, corrugated cardboard, 5 cm wide, same length as straw; 2 straight pins; small piece modeling clay; 2 rubber erasers cut from pencils; tape; copies of Student Page

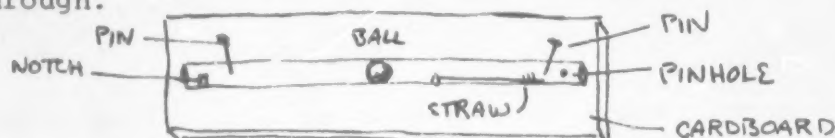
Words To Know

anemometer, velocity, calibration, abiotic



ACTIVITY

1. At one end of the straw cut a small notch 1 cm from the end with a razor blade. Be careful not to cut through the straw or your finger!
2. At the opposite end, on the same side, make a pinhole .5 cm from the end.
3. Tape the three pieces of cardboard together, one on top of another to make three thicknesses.
4. Put the styrofoam ball inside the straw. Center the straw on the cardboard with notch up. Put the pins in as indicated. Push pins through.



5. Put erasers on the ends of the pins on the wrong side of the cardboard.
6. Plug the notched end of the straw with the clay. This is the bottom of your anemometer.
7. The students will calibrate the anemometer with two scales -- low speed and high speed, indicated on either side of the straw. The low speed scale will be measured with the open end of the straw uncovered. The second scale (high speed) will be done with the open end covered.
8. To calibrate the scales, the students will hold the anemometer out the window of a car driven (by a parent) at uniform speeds. The driver should start at 1 mph. The end of the anemometer should be uncovered. Mark the cardboard where the styrofoam ball is. Have the driver proceed at 1 mph intervals. On the other side of the straw, calibrate the high speed scale. Mark the scale on the cardboard at intervals of 10 mph.
9. During class, when the anemometers are completed, ask students to go outside to measure wind velocity at various locations around the school. Ask them to determine the most likely site for a wind-mill.
10. Ask students to write statements of conclusion about wind effects:
 - a. Higher wind speeds occur at tops of hills.
 - b. Wind effects around buildings are most pronounced on the windward side, corners and rooflines.

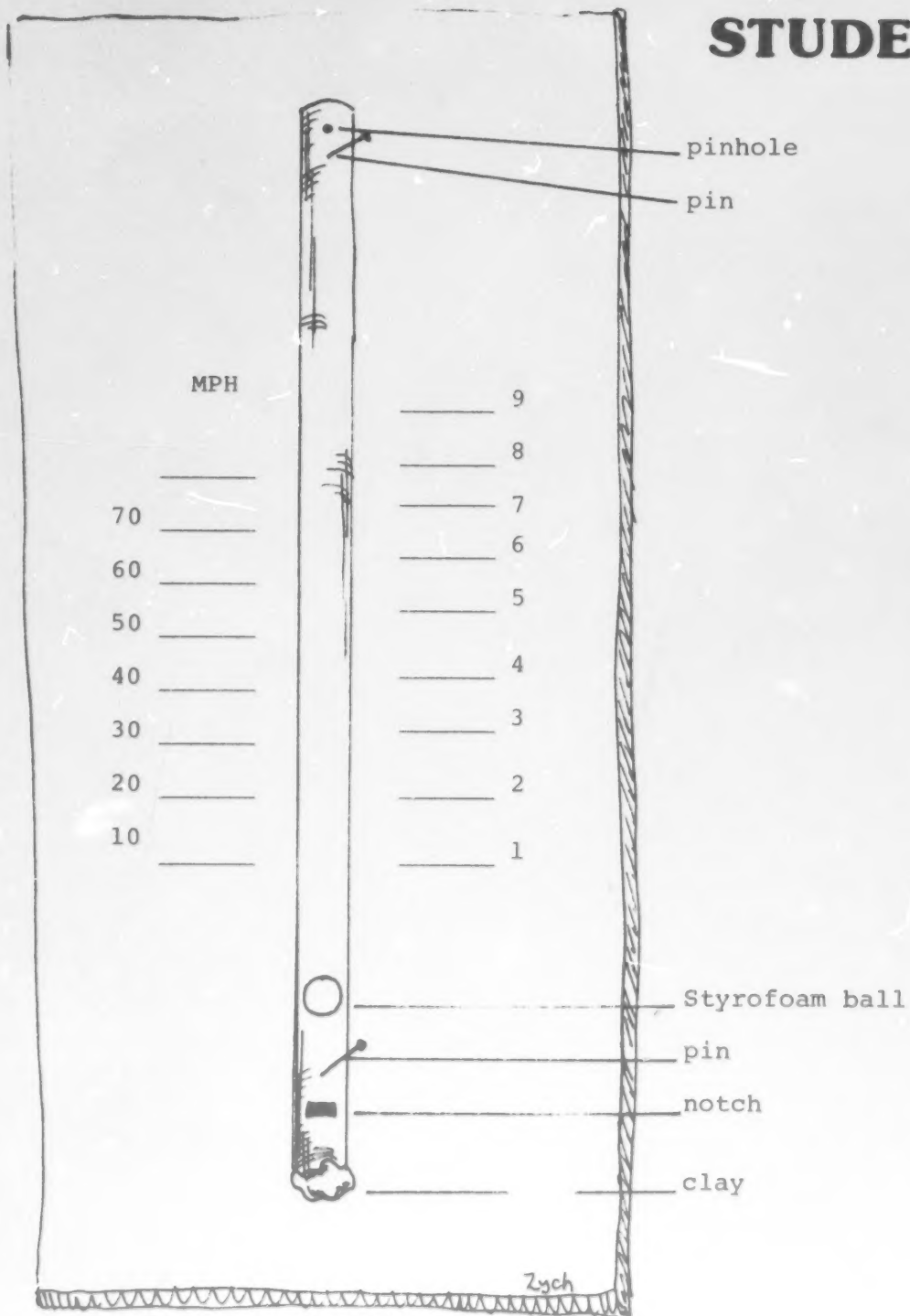
Resources

Dennis, Landt, Catch the Wind, Four Winds Press, New York, 1976
EEC # C86.

Credit

"Stormy Weather", Individualized Science Instructional System,
Ginn & Company, 1976.

Drawings: Cecelia Zych



How Much Energy Do You Use?

Curriculum Topic

ENERGY FORMS: electricity

Subject

Science

Environmental Topic

RESOURCES - ENERGY: conservation

Grade Level(s)

6 - 7

Site

Home
Classroom

Skills

Locating and obtaining information
Using information for a purpose
Evaluating information

Author

Carla McGeeney

Objective

The students will be able to:

1. Identify appliances in their homes which have heating elements.
2. Classify appliances according to wattage used.
3. Calculate approximately and exactly the wattage used.
4. Decide what appliances they could do without in order to conserve electricity.

To The Teacher

Wattage refers to the amount of energy an appliance uses. Household power is measured in kilowatt hours (kwh): wattage multiplied by hours used, divided by 1000. For example, in four hours a 100-watt appliance uses 40 kwh of energy.

Different appliances use different amounts of power. Even different models of the same appliance vary considerably. When electrical energy is changed to heat, such as the heating element on a stove, power is used at a high rate. To conserve electrical energy in the home, therefore, though every conservation effort helps, restricting use of appliances with heating elements helps most of all. Insulation conserves electrical energy by keeping in the heat which electrical energy produces.

By reading the meter on one's house, a student can calculate exactly the amount of power used over a defined period of time.

To read the meter, record the numbers indicated by needles on the four (or five) dials. When the needle is between two numbers, read the lower number. Notice that the numbers on each dial reverse themselves. The number which is on the dial is not the number of kwh used. As the dials move around, the difference between two readings is the amount of power used.

Before You Begin

1. Make a wall chart on which to keep recordings.
2. Make copies of the Appliance Chart (Student Page).

Words To Know

wattage, kilowatt (kwh), electric meter, energy conservation



"Hey, Charlie, I think I've found the bottleneck."

Courtesy B.C. Wildlife Review

Conservation News 12-15-73

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ACTIVITY

1. Place the following examples of dials on the board and have students record their readings:



2. Assign students to bring in readings taken in their homes at 8:00p.m. Record time, date and wattage for each student on a wall chart.
3. Assign a second reading to be taken exactly one week later to the time and day.
4. Subtract and record kwh used for each family.
5. Give students copies of the appliance chart included here. Ask each student to list appliances used in his/her family. List appliances using the greatest wattage and those using the least wattage.
6. Beside each appliance listing, ask students to estimate in hours (using fractions or decimals, if necessary) how much each is used per week. (Example: hairdryer 1.1 hours)
7. Calculate the kilowatt-hours (kwh) for each appliance a student uses.

$$\frac{\text{wattage}}{1000} \times \text{hours used} = \text{kwh}$$
8. Which appliances use the most energy? Do appliances with the highest wattage have the highest energy use (kwh)? Why or why not?
9. Challenge students to cut back on electrical energy consumption. Have a contest to see who can cut back the most during the following week.
10. One week later, have students take a third reading at the same hour.
11. Have students with the greatest reduction in electrical energy use explain how they persuaded their families to decrease electrical use and appliances they were most able to restrict.
12. Discuss ways to conserve energy. The following will help start the discussion:
 - a) take shorter, cooler showers
 - b) skip drying cycle in dishwasher, air-dry
 - c) hang clothes outside to dry whenever possible
 - d) keep thermostat set low
13. Conduct a discussion on the reasons for conserving energy:
 - a) save money for the family
 - b) save natural resources
 - c) reduce pollution
 - d) make the United States more energy independent
 - e) make energy available for industry

Related Activities

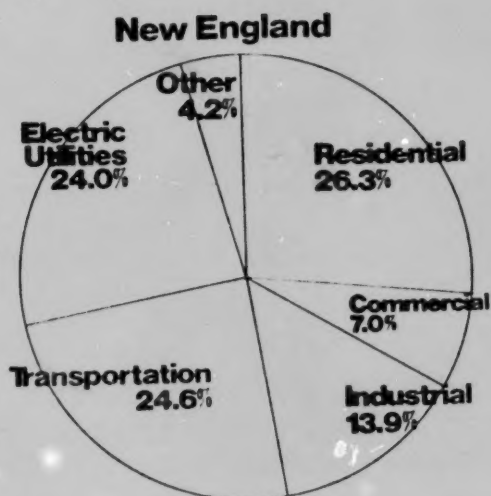
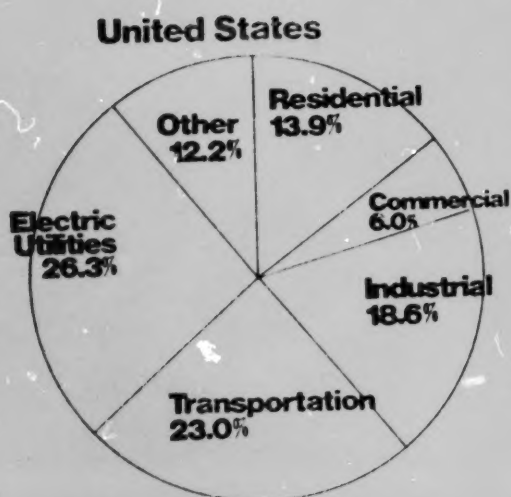
Select a student to call the electric company to learn the rates charged per kwh. Determine the amount of money saved from the energy conserved during the second week.

Credit

"Household Energy," Individualized Science Instructional System, Ginn and Company, 1976

Notes To Myself

Energy Consumption by Sector
1976



Source: S.H. Clark Associates

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STUDENT PAGE

DIRECTIONS:

- 1) IN COLUMN I, CHECK ALL THE APPLIANCES YOUR FAMILY USED LAST WEEK.
- 2) IN COLUMN III, ESTIMATE THE NUMBER OF HOURS YOUR FAMILY USED EACH APPLIANCE LAST WEEK.
- 3) IN COLUMN IV, CALCULATE THE KILOWATT HOURS (KWH) OR THE ENERGY USED BY EACH APPLIANCE IN A WEEK. USE THE FORMULA BELOW:

$$\frac{\text{WATTAGE}}{1000} \times \text{HOURS USED} = \text{KWH}$$

APPLIANCE	COL. 1 (✓)	COL. 2 WATTAGE	COL. 3 HOURS USED	COL. 4 KWH USED
HOME HEATING UNIT		12,000		
OVEN (STOVE)		12,000		
CLOTHES DRYER		5,000		
WATER HEATER (QUICK)		4,500		
WATER HEATER (STANDARD)		2,500		
AIR CONDITIONER		1,500		
BROILER		1,500		
DEEP FAT FRYER		1,500		
PORTABLE HEATER		1,300		
DISHWASHER		1,200		
FRYING PAN		1,200		
TOASTER		1,200		
IRON		1,000		
COFFEE MAKER		900		
VACUUM CLEANER		650		
FROSTLESS REF/ FREEZER		600		
FOOD DISPOSAL		500		
HAIR DRYER		400		
T.V. (COLOR)		350		
T.V. (B & W)		250		
FLOOR POLISHER		300		
INFRARED HEAT LAMP		250		
WINDOW FAN		200		
CARVING KNIFE		100		

STUDENT PAGE, CONT'D.

FOOD BLENDER	400		
STEREO	100		
SEWING MACHINE	75		
RADIO	70		
SHAVER	15		
TOOTHBRUSH	7		
CLOCK	2		

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Energy Checklist for the Home

Curriculum Topic

EARTH SCIENCE - ENERGY CONSERVATION

Subject

Science

Environmental Topic

ENERGY RESOURCES: Conservation and Management of Energy

Grade Level(s)

6-8

Site

Home, Classroom

Skills

Locating and obtaining information, concluding

Author

Thomas J. Kotulski

Objective

Students will be able to:

1. generalize from the data their own habits in the use of energy,
2. identify areas where energy savings could be accomplished.

To The Teacher

This activity is to identify, for students, areas of their own lifestyles where energy-conservation practices could be instituted. It does not quantify energy-loss nor estimate the cost of alleviating the problem, but rather, gives students an over-all picture of their energy-consumption practices. One way to use this activity is to assign it as homework during an energy study unit.

1. Energy from the sun: How is your house insulated/heated?
2. The 2nd law of thermodynamics: Energy wasted in the home is energy and money permanently lost.
3. Sea and land breezes: Heating and cooling the home.

"Americans use more energy per person than any other people in the world. We have only 6 percent of the world's population, but we use about one-third of all the energy consumed on this globe. Our total national energy cost in 1975 amounted to about \$170 billion, and each year this cost is steadily rising.

"Where does all this energy go?

"Our industry takes about 36 per cent. Our commerce uses about 11 per cent for enterprises including stores, offices, schools, and hospitals. Our residences take about 26 per cent. And transportation accounts for another 29 per cent or so.

"Most of the energy we use in the United States comes from petroleum (crude oil). Because domestic production falls short of our needs, we have to import almost half of it, at a cost of \$45 billion a year (at 1977 rates).

"Expert estimates of our known and potential domestic reserves vary, but most likely we have somewhere between a 25 to 30 year supply of oil, if we keep our energy-use growth rate at about 2 per cent per year.

"However, if we continue using energy as we have become accustomed to, we could run out of domestic oil supplies in the year 2007, and we may run out of natural gas even sooner. The severe winter of 1976-1977 painfully dramatized the natural gas situation with its complex supply and economic problems.

"The overall energy situation in the United States is not rosy: Energy demand keeps rising; energy prices keep going up; the availability and future costs of supplies remain uncertain.

"What can we do about it?

"Conserve energy. This will help us extend our supplies and reduce our import burdens until we develop new energy technologies and resources.

"Without personal hardship, we could easily cut our energy use by an estimated 30 per cent or more -- saving energy for our country and money for ourselves.

"The energy we use for our homes and automobiles -- gas, oil, electricity -- draws on all of our energy resources. Cutting back on these uses is the simplest, most effective way to make our resources last longer. And each individual conservation effort, multiplied by millions, can serve as an "energy bank" -- a supply that can be used to help balance our energy accounts." (From "Tips for Energy Savers")

Words To Know

energy conservation, insulation

ACTIVITY

1. Hand out the "Residential Energy Checklist" as a homework assignment.
2. On the next day, tabulate the class results and discuss. Students can make a list of key areas of energy waste and compare it to corresponding lists of energy-saving procedures.

Resources

Energy Conservation in the Home; U.S. Department of Energy
"Tips for Energy Savers", Federal Energy Administration 77/212,
August, 1977; excellent.

Credit

Checklist excerpted from Energy Conservation in the Home; University
of Tennessee, 1976.

Notes To Myself

- If you answered with 65 or more yes's, you are truly an energy conserver and will make a good conservation advocate.
- If you answered with 55 to 65 yes's, you are energy conscious but lack will-power or drive.
- If you answered with 45 to 54 yes's, you are wasting energy but with minor changes could make a conserver.
- If you answered with 35 to 44 yes's, you are an energy waster and should make an all-out effort to reform!
- If you answered with less than 35 yes's, you are making an effort to waste energy and should consider the long range and immediate effects!!

STUDENT PAGE

RESIDENTIAL ENERGY CHECKLIST

House: The Shell

yes

no

1. Are plants properly located around the house to provide a break against wind and shade against unwanted sun?
2. Are drapes and furniture located so they do not obstruct heating, air-conditioning or ventilation?
3. Are draperies insulated?
4. Do draperies fit snugly around the window?
5. Are exterior house doors closed quickly after use?
6. Are lights and appliances turned off after use?
7. Do you have storm windows and doors?
8. Are all doors and windows properly caulked and weatherstripped?
9. Are draperies and shades closed at night and on cloudy, windy days during the heating season?
10. Are draperies opened to admit sunlight on sunny days in the heating season?
11. Are draperies and shades closed on sunny days during the cooling season?
12. Is the attic ventilated?
13. Is the attic insulated to 6-8"?
14. Are the walls insulated?
15. Do floors exposed to unheated or cooled air have from 2-3½" of insulation?
16. Is the fireplace damper closed when not in use?
17. Is the den, gameroom or family room oriented to the south?
18. Is the house shaded from the western sun?

	yes	no
19. Does your home have window area equivalent to 10% or less of its square footage?		
20. Is your home sealed from drafts? Is it free from cracks and holes?		
21. Does your home have fluorescent lighting where appropriate?		
22. Does your home have wall-to-wall carpeting?		
23. Do all windows have drapery, shades, blinds, shutters or other covering?		
<u>Environmental Control</u>		
24. Are ducts, radiators or air-conditioners closed off in unused rooms or closets?		
25. Are hot water pipes insulated in unheated and uncooled spaces?		
26. Are air ducts insulated in unheated and uncooled spaces?		
27. Is the thermostat set at 68°F or below during the heating season?		
28. Is the thermostat set at 78°F or above during the cooling season?		
29. Are heating and cooling filters clean?		
30. Is the thermostat turned back at night?		
31. Are windows and doors tightly closed while mechanically heating or cooling?		
32. Is an attic fan used in the summer?		
33. Do thermostats indicate correct temperature settings?		
34. Is an outside air-conditioning unit located on the shady (north) side of the house?		
35. Is the water heater insulated?		
36. Is the water heater temperature setting at 140°F or less?		

- | | yes | no |
|---|-----|----|
| 37. Is the air-conditioning unit properly sized for your needs? | | |
| 38. Do you have a heat pump? | | |
| 39. Do you use natural ventilation as much as possible? | | |
| 40. Are radiators and other heating or cooling equipment clean and dust free? | | |
| 41. Is the water heater located in a heated space? | | |

Housing Selection

- | | | |
|---|--|--|
| 42. If you live in an apartment, is it an "inside" apartment? | | |
| 43. If you live in a mobile home, does it have a "skirt"? | | |
| 44. If you live in an older home, have its plumbing, wiring, insulation and chimneys been checked by "experts"? | | |

Food

- | | | |
|--|--|--|
| 45. Is the frost on the refrigerator and freezer less than $\frac{1}{4}$ inch thick? | | |
| 46. Is the refrigerator set at 40°F? | | |
| 47. Is the freezer set at 10°F? | | |
| 48. Are gaskets around refrigerators and freezers tight? | | |
| 49. Is the oven used to bake more than one food at a time? | | |
| 50. Is the gasket around ovens tight? | | |
| 51. Are frozen foods thawed completely before cooking? | | |
| 52. Is the cooking range turned off immediately after use? | | |

- | | yes | no |
|--|-----|----|
| 53. Are dishes washed only when there is a full load? | | |
| 54. Are dishes allowed to air dry? | | |
| 55. Are appliances clean and dust free (particularly cooling coils)? | | |
| 56. Is the oven never used as a dryer or heater? | | |
| 57. Are flat bottom pots and pans used? | | |
| 58. Is a timer used to avoid over-cooking? | | |
| 59. Are pots covered during cooking? | | |
| 60. Is as little water used as possible during cooking? | | |
| 61. Is the heated dry cycle on the dishwasher not used? | | |

Clothing

- | | | |
|---|--|--|
| 62. Does your family dress warmer in cool weather to avoid mechanical heating? | | |
| 63. Does your family dress cooler in warm weather to avoid mechanical cooling? | | |
| 64. Are clothes washed only when there is a full load? | | |
| 65. When washing is cold or warm water used when possible? | | |
| 66. Are clothes line dried when possible? | | |
| 67. Are most of your family's clothes wash-and-wear, permanent press to avoid dry cleaning and ironing? | | |
| 68. Are clothes always rinsed with cold water? | | |
| 69. Is the washer located near the water heater? | | |
| 70. Is the dryer lint screen cleaned after each load? | | |

Personal Care

71. Do the members of your family take short showers or use only small amounts of water for tub baths?
72. Are all water faucets repaired and not leaking?
73. For washing, shaving or make-up is the lavatory filled rather than allowing water to run?

yes

no

Entertainment

74. Are entertainment devices turned off when not in use?
75. Do members of your family try to entertain themselves rather than rely on devices?

--If you answered with 65 or more yes's, you are truly an energy conserver and will make a good conservation advocate.

--If you answered with 55 to 65 yes's, you are energy conscious but lack will-power or drive.

--If you answered with 45 to 54 yes's, you are wasting energy but with minor changes could make a conserver.

--If you answered with 35 to 44 yes's, you are an energy waster and should make an all-out effort to reform!

--If you answered with less than 35 yes's, you are making an effort to waste energy and should consider the long range and immediate effects!!

ABC of BTU Conditioning

Curriculum Topic

ENERGY

Subject

Science - General Science
Earth Science

Environmental Topic

ENERGY RESOURCES

Grade Level(s)

6-8

Site

Classroom

Skills

Computing skills

Author

Thomas J. Kotulski

Objective

Students will be able to:

1. compute the number of BTU's needed to cool a designated area.

To The Teacher

"Energy, though not easily defined, is not easily ignored. Man's senses respond to a variety of energy forms. The eyes respond to light energy. The ears detect sound energy. Other nerves indicate contact with thermal and electrical energy. These energy forms are interconnected and exchangeable; different forms of energy can be used for the same purpose; energy can be stored or transformed. But probably the most common and important characteristic of energy is its capacity for doing work.

"The British thermal unit (Btu) is the amount of heat energy required to raise the temperature of one pound of water one degree Fahrenheit. The Btu is commonly used by engineers to specify the total amount of energy used for some specific purpose; for example, an air conditioner may have a cooling capacity of 8,000 Btu's per hour. The Btu is also used to specify the energy content of primary fuels or energy resources; for example:

'Each gallon of gasoline has a heating value of about 136,000 Btu. (Heating value is the maximum amount of energy released when fuel combines with oxygen in a combustion process.) If an automobile gets ten miles per gallon of gasoline, then it takes about 13,600 Btu to drive the car each mile.'" (Weast, p. 81)

from Energy Conservation in the Home, U.S. Dept. of Energy.

This activity will relate the concept of energy as the ability to do work to a typical energy task - the cooling of a room via air conditioning.

Before You Begin

Preparation: Be sure students understand the meaning of Btu (see To the Teacher) and EER. The EER, Energy Efficiency Ratio, is obtained by measuring in Btu's the capacity of an energy-user (e.g. air conditioner) and then dividing this number by the number of watts the unit uses. (e.g. $4000 \text{ Btu} \div 780 \text{ watts} = \text{EER of } 5.1$) The higher the EER, the more efficient the unit. Maximum efficiency of an air conditioner is approximately 11.5 to a low of 5.4. High efficiency units must have an EER of at least 7.5. An 11.5 EER unit is more than 2 times as efficient as a 5.4 EER unit and uses less than 1/2 the electrical energy.

Words To Know

BTU, EER, watts, volts, amperage, conduction



But what if we pass the 30% saving on electricity on to the consumer, and then the nuclear power plant blows up?

Courtesy of
BULLETIN OF THE ATOMIC SCIENTISTS

Conservation News 2-15-75

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ACTIVITY

Instruct the students to fill in the student sheets in order to estimate cooling loads in the areas you designate. Students will calculate the number of BTU's per hour which are admitted to the room. This figure will indicate the cooling capacity of an air conditioner necessary to adequately cool the room.

Related Activities

Determine if your home air conditioners are adequate for the cooling requirements of the rooms.

Resources

Consumer Reports 1978, pp. 279-286.

Energy Conservation in the Home, EDM 1028, US Dept. of Energy, October 1977, Technical Information Center, P.O. Box 62, Oak Ridge TN 37820

Notes To Myself

STUDENT PAGE

COOLING LOAD ESTIMATE FORM

1. HEAT GAINED FROM DOORS AND ARCHES.

A. MULTIPLY BY 300 THE WIDTH OF A DOOR OR ARCH BETWEEN ROOMS TO BE COOLED. DO THIS FOR EACH DOOR OR ARCH IN THE ROOM. IF THE ROOMS ARE CONNECTED BY A DOOR OR AN ARCH GREATER THAN 5' WIDE, TREAT THE TWO ROOMS AS ONE. RECORD YOUR ANSWER ON YOUR RECORD SHEET.

2. SUN THROUGH WINDOW.

MULTIPLY WINDOW AREA (FT²) FOR EACH EXPOSURE USING THE FACTORS LISTED BELOW. HINT: USE THE FACTOR "INSIDE SHADES" IF THE WINDOW HAS BLINDS/SHADES. IF A WINDOW HAS AN AWNING, USE THE FACTOR LISTED "AWNING". FACTORS ARE FOR SINGLE PANE GLASS. IF WINDOWS ARE DOUBLE PANED OR STORM WINDOWED MULTIPLY EACH FACTOR BY .8.

		No shades	Inside shades/drapes	Awning	Answer
If the window faces:	NE	60	25	20	_____
	E	80	40	25	_____
	SE	75	30	20	_____
	S	75	35	20	_____
	SW	110	45	30	_____
	W	150	65	45	_____
	NW	120	50	35	_____
	N	0	0	0	_____

multiply square
footage of the
window by

On your Student Record Sheet record only the largest answer you obtain. Do not total the Answers.

3. CONDUCTION THROUGH WINDOWS.

CALCULATE THE TOTAL AREA (FT²) OF ALL WINDOWS. MULTIPLY THIS TOTAL BY 14, IF WINDOWS ARE SINGLE PANED, BY 7 ALL OTHER TYPES.

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4. HEAT GAINED THROUGH WALLS.

CALCULATE THE AREA OF THE WALL BY MULTIPLYING THE LENGTH OF THE WALL BY ITS HEIGHT AND SUBTRACTING FROM THAT TOTAL THE SQUARE FOOTAGE OF ANY WINDOWS OR DOORS IN THAT WALL. IF THE WALL IS INSULATED OR MADE OF MASONRY, MULTIPLY THE TOTAL AREA (FT²) BY THE APPROPRIATE NUMBERS FROM COLUMN B. IF THE WALL IS NOT INSULATED, MULTIPLY THE TOTAL AREA (FT²) BY THE NUMBER IN COLUMN A. TOTAL YOUR RESULTS FOR ALL WALLS AND RECORD ON ANSWER SHEET.

	(NO INSULATION)	(INSULATION)
	A	B
WALLS OF A NORTHERN EXPOSURE	30	20
WALLS OF ALL OTHER EXPOSURES	60	30

5. HEAT GAINED THROUGH THE CEILING.

CALCULATE THE AREA (FT²) OF THE CEILING AND MULTIPLY THIS FIGURE BY:

- 19 IF UNINSULATED WITH NO SPACE ABOVE
- 8 IF INSULATED WITH NO SPACE ABOVE
- 12 IF UNINSULATED WITH ATTIC SPACE ABOVE
- 5 IF INSULATED WITH ATTIC SPACE ABOVE
- 3 IF SPACE ABOVE IS OCCUPIED

RECORD ANSWER.

6. HEAT GAINED THROUGH THE FLOOR.

CALCULATE THE AREA (FT²) OF THE FLOOR AREA. MULTIPLY THIS NUMBER BY 3. RECORD YOUR ANSWER.

7. NOW ADD TOGETHER ANSWERS 1 - 6 AND RECORD.

8. MULTIPLY THE ANSWER IN #7 BY A CLIMATE CORRECTION FACTOR. FOR OUR AREA OF THE US, NEW ENGLAND, THIS NUMBER IS 1.0.

9. PEOPLE

MULTIPLY THE NUMBER OF PEOPLE WHO USE THE COOLED SPACE BY 600 AND ADD THIS NUMBER TO THE TOTAL IN #8.

10. THE TOTAL NUMBER IN #10 IS THE NUMBER OF BTU'S OF HEAT ADMITTED INTO THE ROOM PER HOUR. THE BTU COOLING CAPACITY OF AN AIR CONDITIONER SHOULD COME WITHIN 10% OF THE TOTAL BTU'S OF HEAT ADMITTED INTO THE ROOM.

CHECK THE BTU COOLING CAPACITY OF THE AIR CONDITIONER IN THE ROOM YOU ARE MEASURING. YOU MAY NEED THE INSTRUCTION MANUAL.

STUDENT RECORD SHEET

- 1) HEAT GAINED FROM DOORS AND ARCHES _____.
- 2) SUN THROUGH WINDOWS _____.
- 3) CONDUCTION THROUGH WINDOWS _____.
- 4) HEAT GAINED THROUGH WALLS _____.
- 5) HEAT GAINED THROUGH THE CEILING _____.
- 6) HEAT GAINED THROUGH THE FLOOR _____.
- 7) TOTAL OF NUMBERS 1 - 6 _____.
- 8) CLIMATE CORRECTION FACTOR (1.0) X TOTAL _____.
- 9) NUMBER OF PEOPLE X 600 _____.
- 10) TOTAL OF #8 AND #9 _____.

YOUR ANSWER IS THE NUMBER OF BTU'S OF HEAT ADMITTED TO THE ROOM PER HOUR.

307

How Much Water Does Your Household Consume?

Curriculum Topic

EARTH SCIENCE

Subject

Science

Environmental Topic

ENERGY - RESOURCES: Water

Grade Level(s)

6-8

Site

Classroom

Skills

Problem solving, interpreting data, inferring from data

Author

Thomas J. Kotulski

Objective

After completing the activity the student will be able to:

1. list the ways we use water.
2. differentiate between essential and non-essential uses of water.
3. suggest ways one can eliminate or reduce water waste.

To The Teacher

That water is essential in today's world is an understatement. From a physiological level it plays a critical role in maintaining blood pressure, food breakdown, protein catabolism etc...and from a daily level we use it to clean bodies, drink, swim in. In the United States we have been blessed with an abundance of "good" water. However, abundance has a limit. We are approaching, if not exceeding, that limit in many areas of the country.

As potential stewards of the earth, we must have a clear idea of exactly what our demands upon the resources of the Earth will involve. From this point we can perceive problems and intelligently make sound decisions.

This activity is designed to give students an understanding of just how much water they consume in their daily lives. The activity offers an approach to the ways we can become water stewards of the Earth.

Before You Begin

Materials: water worksheet (student copy), pencils

Words To Know

water, consumption, usage, ration, draught, limit, steward



ACTIVITY

1. Have each student estimate the amount of water consumed weekly by their family.
2. Pass out student worksheet.
3. Explain its purpose (see Objective) The students should calculate their family's water consumption per week and per year.
4. Allow 30-45 minutes to complete the survey.
5. After completing the assignment, conduct a class discussion of patterns of water consumption using student questions as a discussion guide.

Related Activities

1. Find out: water sources: How is your water treated?
What is added to your water and why?
How to read your water meter (1 cubic foot = 7.5 gal.)

Make a bar graph showing daily useage.

Compare students charts.

2. Study the distribution of the world's water resources. Compare world maps showing rainfall and population distribution.
What conclusions can you draw?
What areas have recently experienced severe draught.

Resources

Turk, et. al., Environmental Science, Saunders Publishing Co., 1976, p. 9.

Credit

Schaefer, Larry and Harry O. Haakonsen, "Hydrosystems", Unit of the Land Use Decision Making Kit, E-P Education Services, New Haven, CT, 1975.

Drawing: Cecelia Zych

Notes To Myself

STUDENT PAGE

HOW MUCH WATER DOES YOUR HOUSEHOLD CONSUME?

WATER UTILITY STUDIES HAVE REPORTED THE AVERAGE CONSUMPTION OF WATER IN HOUSEHOLDS AS RECORDED IN THE TABLE BELOW:

ACTIVITY	WATER CONSUMPTION
Flushing toilet	4 gal/flush
Shower	30 gal/shower or 7 gal/min.
Bathtub	40 gal/bath
Washing machine	40 gal/load
Dishwasher	40 gal/load or sinkful
Drinking	1 gal/day
Food preparation and housing maintenance	100 gal/day
Washing face in sink	1-2 gal
Watering lawn	10 gal/min

ANSWER THE FOLLOWING QUESTIONS AND PERFORM THE SIMPLE CALCULATIONS REQUIRED TO ESTIMATE THE WATER CONSUMPTION OF YOUR HOUSEHOLD.

- How many people in your family? _____
- How many showers per week do you take? _____
- How many baths per week do you take? _____
- On the average, how many times per day do you flush the toilet? _____
- In the summer, how many hours per week does your family water its lawn? _____
- How many washing machine loads are necessary for washing dirty clothes in your family in one week? _____
- On the average, how many times is the dishwasher run a day or how many times are dishes washed by hand each day? _____
- Water consumption from showers in gallons per week

$$\frac{\text{(answer to Q \# 1)}}{\text{(answer to Q \# 2)}} \times 30 \text{ gal/shower} = \text{_____ gal/week}$$
 in showers.
- Water consumption from baths in gallons/week

$$\frac{\text{(answer to Q \# 1)}}{\text{(answer to Q \# 3)}} \times 40 \text{ gal/bath} = \text{_____ gal/week}$$
 consumed in baths.
- Water consumption from flushing toilets in gallons/week

$$\frac{\text{(answer to Q \# 1)}}{\text{(answer to Q \# 4)}} \times 7 \text{ days/week} \times 4 \text{ gal/flush} = \text{_____ gal/week}$$
 consumed in flushing the toilet.
- Water consumption from washing clothes in gallons/week

$$\frac{\text{(answer to Q \# 6)}}{\text{(answer to Q \# 6)}} \times 40 \text{ gal/load} = \text{_____ gal/week}$$
 consumed in washing clothes.
- Water consumption from dishwashing in gallons/week

$$\frac{\text{(answer to Q \# 7)}}{\text{(answer to Q \# 7)}} \times 40 \text{ gal/load or sinkful} \times 7 \text{ days/week} = \text{_____ gal/week}$$
 consumed in dishwashing.
- Water consumption from watering lawn in gallons/week

$$\frac{\text{(answer to Q \# 5)}}{\text{(answer to Q \# 5)}} \times 60 \text{ min/hr} \times 10 \text{ gal/min} = \text{_____ gal/week}$$
 consumed in watering lawns.

14. Water consumption in bathroom sink (assuming you wash hand and face three times/day) _____ X 3 times/day X 7 day/week X 1.5 gal/facial and

(answer to Q # 1)

handwash = _____ gal/week in bathroom sink.

15. Water consumption from food preparation and housing maintenance (for average family of 5) 100 gal/day X 7 days/week = 700 gal/week.

16. Total water consumption per week

$$\begin{array}{r} \text{ans. Q \# 8} + \text{ans. Q \# 9} + \text{ans. Q \# 10} + \text{ans. Q \# 11} + \text{ans. Q \# 12} + \text{ans. Q \# 13} \\ \hline \text{ans. Q \# 14} + \text{ans. Q \# 15} = \text{gallons/week} \end{array}$$

Total

17. Total water consumption per year

X 52 weeks/year = _____ total gallons water/year.

(answer to Q # 16)

STUDENTS QUESTIONS

Answer after you have completed the Student Worksheet.

- Which activities in your family consume the most water? The least?
- In which activities would it be possible to conserve water?
- Assume there is a severe draught. The water commissioner has announced that water must be rationed. All families must reduce their water usage by 20%. How would you cope with the commissioner's order? What areas would you cut back? Rank those areas you would cut back: 1st, 2nd, 3rd etc.
- What methods can be used to institute and enforce conservation in the areas listed in question # 3.

SOLAR COLLECTOR ON ROOF OF HOUSE



What To Do With Leftovers

Curriculum Topic

ECOLOGY

Subject

Science

Environmental Topic

ENERGY AND RESOURCES:

Grade Level(s)

7-8

Site

Laboratory

Skills

Information skills

Author

Pat Perrella

Objective

Students will be able to:

1. describe the method by which paper is recycled.

To The Teacher

Recycling is the reuse of partially-used, discarded materials. By recycling, resources are used over and over again in a manner similar to the cycle of natural elements such as carbon, nitrogen and oxygen. Reuse of matter is in contrast to flow of material from earth to home to garbage such as our present production system requires.

Recycling is important for two reasons:

1. America is running out of the raw materials required to make products. Fuels, timber, and mineral supplies are not without limits.
2. Non or semi-decomposable products are not recycled, they remain as useless waste. We then are faced with the increasingly difficult problem of disposal.

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Before You Begin

Before students begin the activity, you might want to discuss with them the importance of recycling and explain briefly how paper is recycled commercially.

Words To Know

A black and white cartoon by J. A. Morris. It depicts two men in a room. On the left, a man in a suit and fedora stands with his arms crossed, looking towards the other man. On the right, a man in a cap and a heavy coat is seated at a table, looking down at a small object on a stand. The table is cluttered with several large stacks of money and a small box. A lamp hangs above the table, and a window is visible in the background. The signature 'J. A. Morris' is at the bottom right.

Journal of Management Education

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ACTIVITY

1. Divide students into lab groups of 2 or 3 students.
2. Distribute materials and supervise lab activity. (u.b. If class period is short, you may ask students to do Step 1 as preparation on the day before the activity.)

Related Activities

Assign students to investigate for sites in their areas where paper is collected for recycling.

Resources

"Teaching Activities in Environmental Education", ed. J. H. Wheatley & H.L. Coon, Vol. 11, The Eric Center for Science, Mathematics, and Environmental Education Information, p. 86, EEC #60.3.

The Environmental Handbook, ed. Garret de Bell, Ballantine Books, 1970, pp. 214-215.

Credit

Ecology Action Pack, McDonald's Corporation, Oak Brook, IL, 1973.

Notes To Myself

STUDENT PAGE

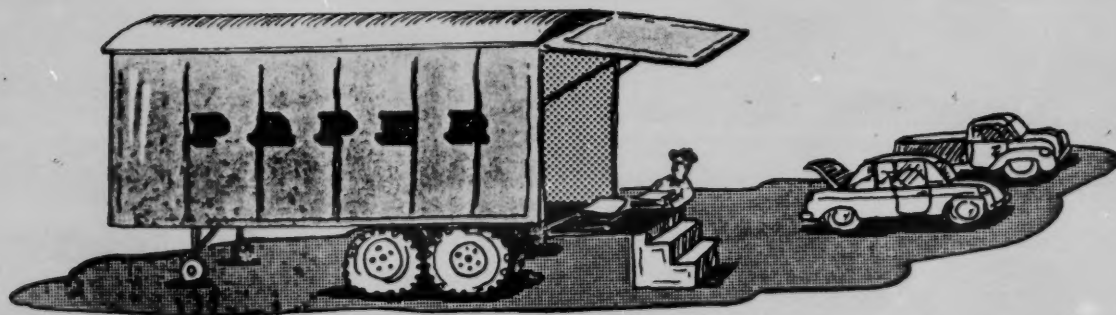
DIRECTIONS FOR STUDENTS

FOLLOW THESE STEPS TO RECYCLE YOUR OWN PAPER!

1. FILL THE BOWL $\frac{1}{4}$ FULL OF WATER. TEAR A HALF PAGE OF NEWSPAPER INTO TINY PIECES. PLACE THE PIECES IN THE BOWL AND LET THEM SOAK FOR AT LEAST ONE HOUR.
2. WHEN THE PAPER IS THOROUGHLY SOAKED, BEAT IT WITH AN EGG BEATER UNTIL THE PAPER IS BROKEN INTO FIBERS. WHEN THE MIXTURE HAS BEEN BEATEN ENOUGH IT WILL HAVE THE CREAMY TEXTURE OF PULP (THE MOIST, SOFT MASS FROM WHICH PAPER IS MADE).
3. DISSOLVE 2 HEAPING TABLESPOONS OF WALLPAPER PASTE OR CORNSTARCH IN A PINT OF WATER. POUR INTO THE PULP AND STIR.
4. HOLD THE PIECE OF WINDOW SCREEN FLAT AS YOU LOWER IT INTO THE PULP. REPEAT UNTIL THERE IS A LAYER OF PULP ON THE SCREEN ABOUT $\frac{1}{16}$ TH INCH THICK.
5. PUT THE PULP-COVERED SCREEN ON A NEWSPAPER AND PLACE A PLASTIC BAG FLAT OVER IT. PRESS DOWN ON THESE WITH THE WOOD BLOCK -- GENTLY AT FIRST, THEN WITH MORE PRESSURE. THE WATER WILL BE FORCED THROUGH THE SCREEN ONTO THE NEWSPAPER.
6. ALLOW THE FIBERS TO DRY FOR ABOUT 24 HOURS.

DAY 2: PEEL THE FIBERS FROM THE SCREEN. HERE IS YOUR RECYCLED PAPER.

Paper Recovery



An Energy Ethic

Curriculum Topic

ENERGY FORMS - ELECTRICITY

Subject

Science

Environmental Topic

RESOURCES - ENERGY

Grade Level(s)

6-8

Site

Classroom

Skills

Valuing, critical thinking

Author

Ed. Lisk

Objective

The student will be able to:

1. evaluate his/her dependency upon electricity.

To The Teacher

Everything we do uses energy in some form. Large amounts of our energy consumption is indirect. Encourage the students to look for the "hidden" or indirect use of energy that accompanies all our products and activities.

This is an activity in values clarification. The major aim of the values clarification approach is to help students identify their own personal values relative to specific issues or problems.

Before You Begin

Preparation: Duplicate worksheet for class distribution.

Words To Know

priorities, energy intensive, conservation

ACTIVITY

1. Distribute worksheet to class

Related Activities

1. Discuss the relationship between monetary savings and energy conservation.
2. Develop an Energy Alternatives bulletin board.
3. Keep a record of personal energy use per day, week, month.
4. Have student spend a day "without using energy".

Resources

Garvey, G., Energy, Ecology, Economy, W.W. Norton & Co., Inc., 1972.

Home Energy Savers Workbook, Dept. of Planning and Energy Policy, Hartford.

Turk, A., J. Turk, and J. Wittes, Ecology Pollution Environment, W.B. Saunders Company, 1972.

Credit

"An Energy Education/Conservation Curriculum Guide for Home Economics Teachers," University of Tennessee Environment Center and College of Home Economics, Knoxville, EEC # 1074.

Notes To Myself

STUDENT PAGE

TO THE STUDENT: Below is a list of items and activities which require energy for their manufacture, use or disposal. Number (rank) these items in order of importance and necessity to you. Mark your responses in Column A - number 1 being most important through number 20 for least important.

	B	C
_____ hot water for bathing	_____	_____
_____ electric toothbrush	_____	_____
_____ waffle iron	_____	_____
_____ synthetic clothing	_____	_____
_____ reading a book	_____	_____
_____ eating a raw apple	_____	_____
_____ TV dinners	_____	_____
_____ car ride to the store	_____	_____
_____ drive-in movie.	_____	_____
_____ making homemade ice cream	_____	_____
_____ lipstick or cologne	_____	_____
_____ aerosol deodorant	_____	_____
_____ electric hairdryer	_____	_____
_____ bicycle riding	_____	_____
_____ a walk in the sun	_____	_____
_____ candy	_____	_____
_____ nighttime football game	_____	_____
_____ hot lunches	_____	_____
_____ school buses	_____	_____
_____ watching television	_____	_____

A) Now that you have ranked these items according to their importance to you, go back and rank the ones you feel are most energy intensive (use the most energy) in Column B (from 1 to 10). Discuss your answers in class.

B) Now mark in Column C the items you could sacrifice which would help conserve energy. Discuss your answers in class.

C) In the event of an energy crisis and a mandatory 25% cutback in energy useage, what items would you eliminate?

The Ocean — Source of Nutrition for the Future

Curriculum Topic

NUTRITION -

The world population is accelerating at such a rate that the ocean must be tapped to supply new food sources.

Environmental Topic

ENERGY-RESOURCES-

The renewable resource base can be extended by reproduction, growth and management.

Skills

Brainstorming
Information skills
Developing self-confidence

Subject

Home Economics
Science
Social Studies

Grade Level(s)

5 - 8

Site

Classroom

Author

Maryann Cronin Horgan

Objective

Students will:

1. investigate the present world food shortage problem
2. list possible sources of food from the ocean
3. taste foods from the sea which may be important sources of nutrition in the future
4. overcome psychological barriers to foods foreign to their tastes.

To The Teacher

As the combination of urban sprawl and population growth encroach on the availability of farmland, the question of future sources of food is posed with increasing frequency. The role of the ocean as a food supplier is currently being explored. At this time, we depend on the ocean for fish and shellfish. However, there is great potential in the sea for a new crop of edible products. In order to increase the yield of food from the sea, we must finance scientific research in the areas of ocean foods and ocean "farming".

This new field of scientific study is called aquaculture. Aquaculture research is able to decrease the growing time of marine organisms and increase, by breeding, their number and size. In addition, aquaculturists are promoting greater use of such resources as seaweed. Alternate forms of sea food such as fish protein concentrate (FPC) are also being developed by aquaculturists.

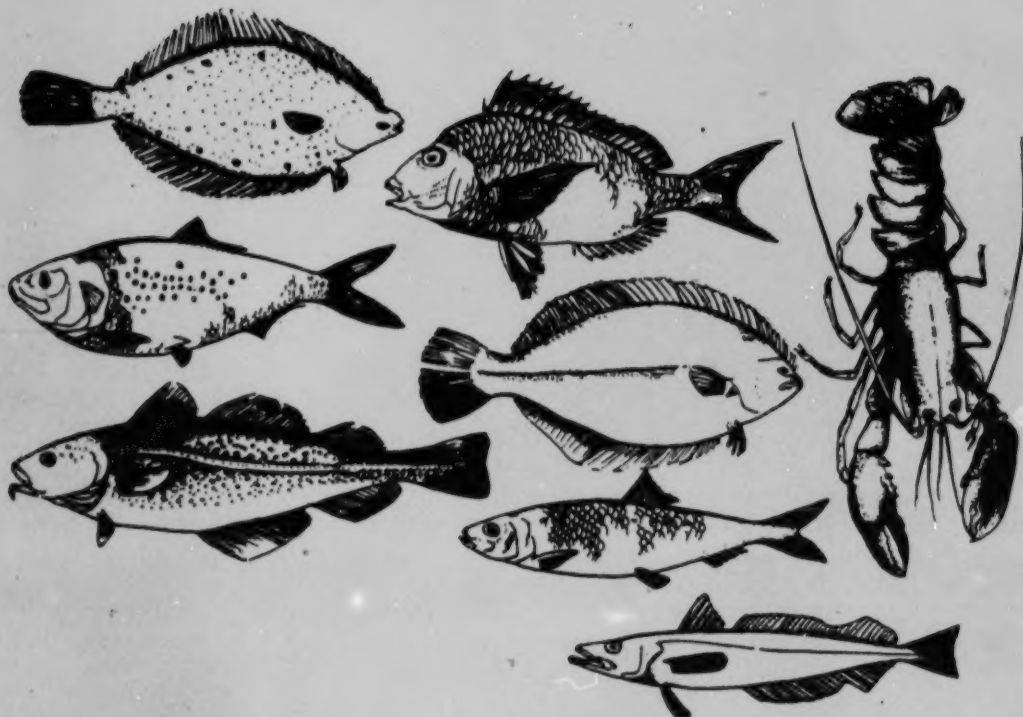
Before You Begin

Materials:

1. Serving dishes, utensils, etc. for a meal
2. Food items (can be found in Oriental food stores and health food stores): Japanese seaweed, seafood (clams, oysters, mussels, shrimp, fish, squid, octopus), clam juice, Fish Protein Concentrate (samples available from Population-Environment Curriculum Study, 310 Willard Hall, University of Delaware, Newark, Del 19711). A commercial FPC (Astra Protein) is produced by Nabisco.
3. Cookbooks such as those by Zachery and Steinberg (see Resources) which include recipes using fish protein concentrate (sample recipes included at the end of the activity).
4. Dittos of class exercise "What Food are You Eating?"

Words To Know

marine organisms, fish protein concentrate, aquaculture, overpopulation, nutrition, algae, seaweed



ACTIVITY

1. Students will list possible food sources from the sea and place an asterisk next to those they have actually tasted.
2. Teacher will prepare a one-portion meal of various seafood products that have potential for increased future use. Label each product with a letter. Do not reveal the contents of the meal to the class. As the students taste each product, they will note their reactions on the ditto, "What Food are You Eating?"
3. When the students have completed the dittos, reveal the contents of each dish. Discuss the results of the dittos.

Related Activities

1. Write reports on the nutritional value of seafood.
2. Collect wrappers and packaging from foods from the sea for a bulletin board display.
3. Set up a marine aquarium in the classroom.
4. Choose one marine organism to research.
5. Go on a trip to a fish hatchery, to a man-made salmon run (such as a salmon ladder over a dam), or to a coastline to collect edible marine life (periwinkles, sea lettuce).

Resources

- Steinberg, R., The Cooking of Japan, Time-Life Books, N.Y., 1969
- Zachery, H., The Beachcomber's Handbook of Seafood Cookery, John F. Blair, Winston-Salem, N.C., 1972

Credit

The activity is based on an activity in the following source:

"The Ocean: Source of Nutrition for the Future," A Learning Experience for Coastal and Oceanic Awareness Studies (COAST), University of Delaware, 1974 EEC# 939

Notes To Myself

STUDENT PAGE

WHAT FOODS ARE YOU EATING?

DIRECTIONS:

1. Guess the main ingredients in each of the foods that you are eating.
2. Star the ingredients that you think may represent an important part of food production and nutrition in the future.

A. APPETIZER:

B. ENTREE:

C. SIDE DISH:

D. BEVERAGE:

E. DESSERT:

LIST THOSE FOODS WHICH YOU LIKED. THEN LIST THOSE FOODS WHICH YOU DISLIKED.

People Who Live in Glass Houses Shouldn't . . .

Curriculum Topic

MATHEMATIC

Subject

Mathematics

Environmental Topic

ENERGY RESOURCES

Grade Level(s)

7 - 8

Site

School building

Skills

Collecting and compiling data,
interpreting data, measuring

Author

Pat Perrella

Objective

Students will determine the percentage of square footage of window area to total wall area and total floor area in various rooms.

To The Teacher

Openings in a home (windows and doors) allow heat to escape in winter and enter in summer. Eight times as much heat will pass through one square foot of window area as will pass through one square foot of wall area. (These figures are compiled for an insulated house with storm windows.) A government report on single-family residences indicates that windows contribute 13.6 per cent of the home's heating load. Heat loss and gain through windows can be reduced by storm panels, weather-stripping, shading devices, and wise placement.

Before You Begin

yardsticks, copies of the student worksheet and directions

Words To Know

insulator, area, per cent

ACTIVITY

1. Review with students the method for computing. Also review the method for changing a fraction into a per cent.
2. Divide class into teams of 2 - 3 students.
3. Distribute metre sticks, worksheets and directions.
4. Before they measure the windows, students will note whether windows have storms. Discuss ways to better insulate existing glassed areas to conserve more energy.
5. Teams will measure the classroom windows. Students will then compute the ratio of window area to floor and wall area. Convert to percentage.
6. When the percentage of square footage of window area to total wall area is computed, teams will repeat the procedure for other rooms in the school: cafeteria, library, other classrooms, laboratory, office, etc. and report back to the class. Record the information on a chart.
7. Present the chart to the school principal with an explanation of whether the building conforms to the building code restrictions and guidelines for the amount of glassed area.

Related Activities

As a homework activity, have students compute ratio of wall area to window area in their homes.

Resources

"Energy Conservation in the Home," University of Tennessee Environment Center and College of Home Economics, Knoxville, Tennessee, 1977, pg. 191.

Notes To Myself

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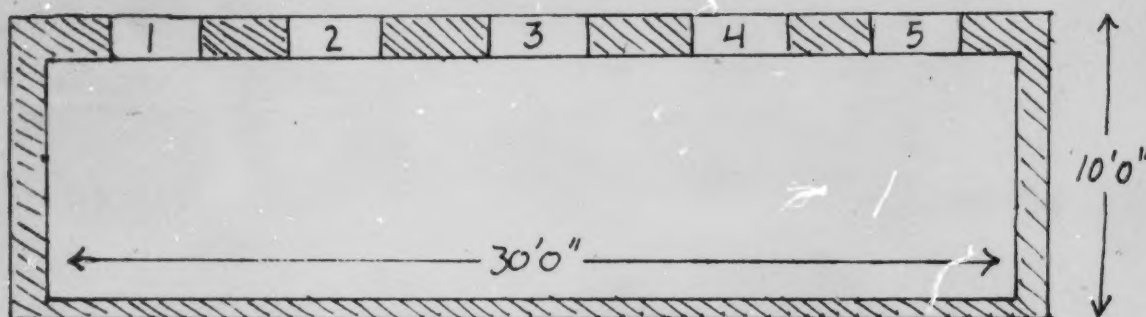
School Building Check: Percentage Glasped Area

[illegible]

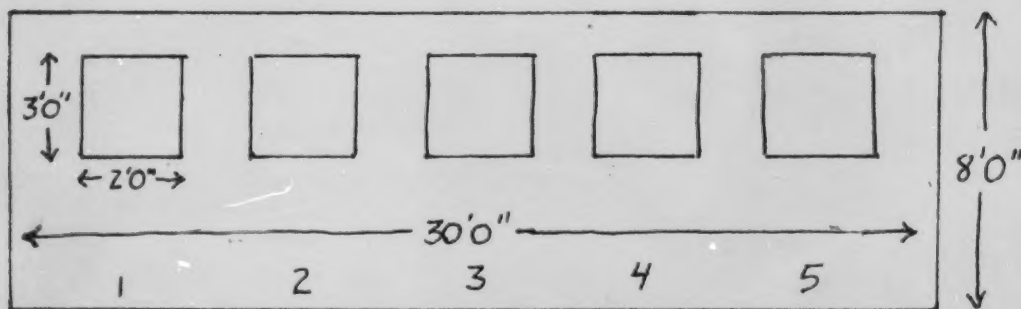
STUDENT PAGE

Student Directions:

Because glass is a much poorer insulator than walls, less glassed areas in a building mean greater possibility of conserving energy for cooling and heating. There are building code restrictions and guidelines for the amount of glassed area: 10% of the total area of the floor and less than 20% of the exterior wall area are generally accepted standards. We will use the following 2 methods to decide if a room meets these guidelines.



This is an elevated view of a room looking down at the floor: The area of the floor, then, is $10' \times 30' = 300$ square feet.



This is an exterior wall.

The total window area is $3' \times 2'$ (each window) $\times 5$ (# of windows) = 30 sq. ft.

Method I:

$$\text{Divide} - \frac{\text{total glassed area}}{\text{total floor area}} \text{ or } \frac{30 \text{ sq. ft.}}{300 \text{ sq. ft.}} \times 100 = 10\%$$

We find this room meets the standard of 10% of floor area. In the example, the total exterior wall area is

$$8' \times 30' = 240 \text{ sq. ft.}$$

Method II

$$\text{Divide} - \frac{\text{total glassed area}}{\text{total exterior wall area}} \text{ or } \frac{30 \text{ sq. ft.}}{240 \text{ sq. ft.}} \times 100 = 12.5\%$$

Using either method, this room is within the guidelines. Now use these methods to see if your classroom meets the guidelines. Use the worksheet to record measurements.

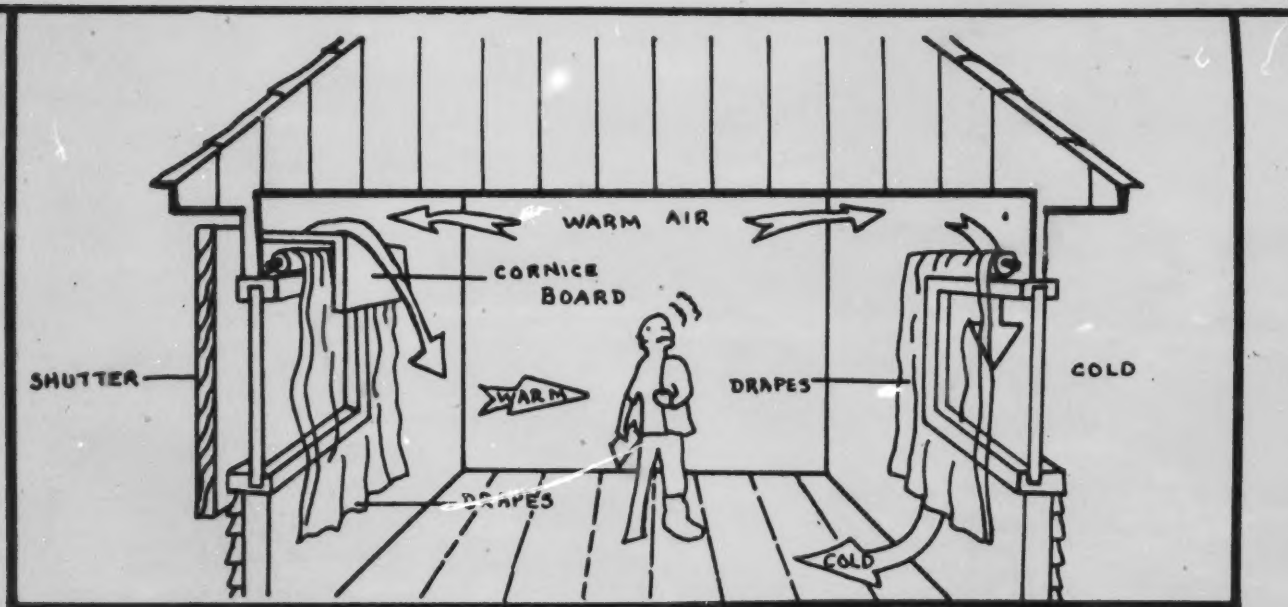


Figure 39. Thermal Effects of Window Treatments.

WORKSHEET

Method I: 10% of floor area or less

Length of floor _____ ft.
Width of floor _____ ft.
Area of floor _____ ft.

Length of window _____ ft.
Width of window _____ ft.
Area of 1 window _____ sq. ft.
Number of windows _____
total glassed area _____ sq. ft.

Total glassed area = _____ x 100 = _____ %
Area of floor

Method II: 20% of exterior wall area or less

Length of wall _____ ft.
Width of wall _____ ft.
Area of wall _____ sq. ft.

Total glassed area = _____ x 100 = _____ %
Total walled area

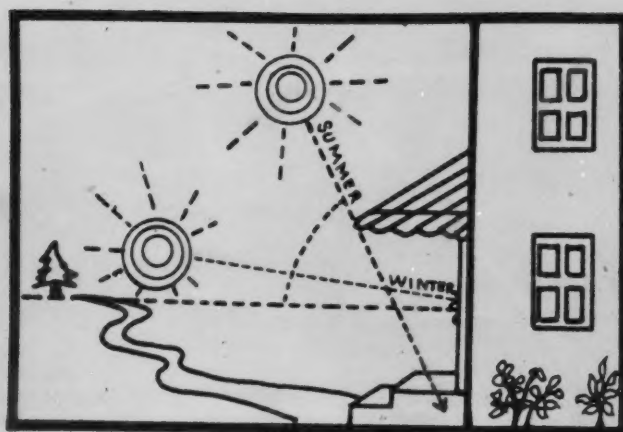
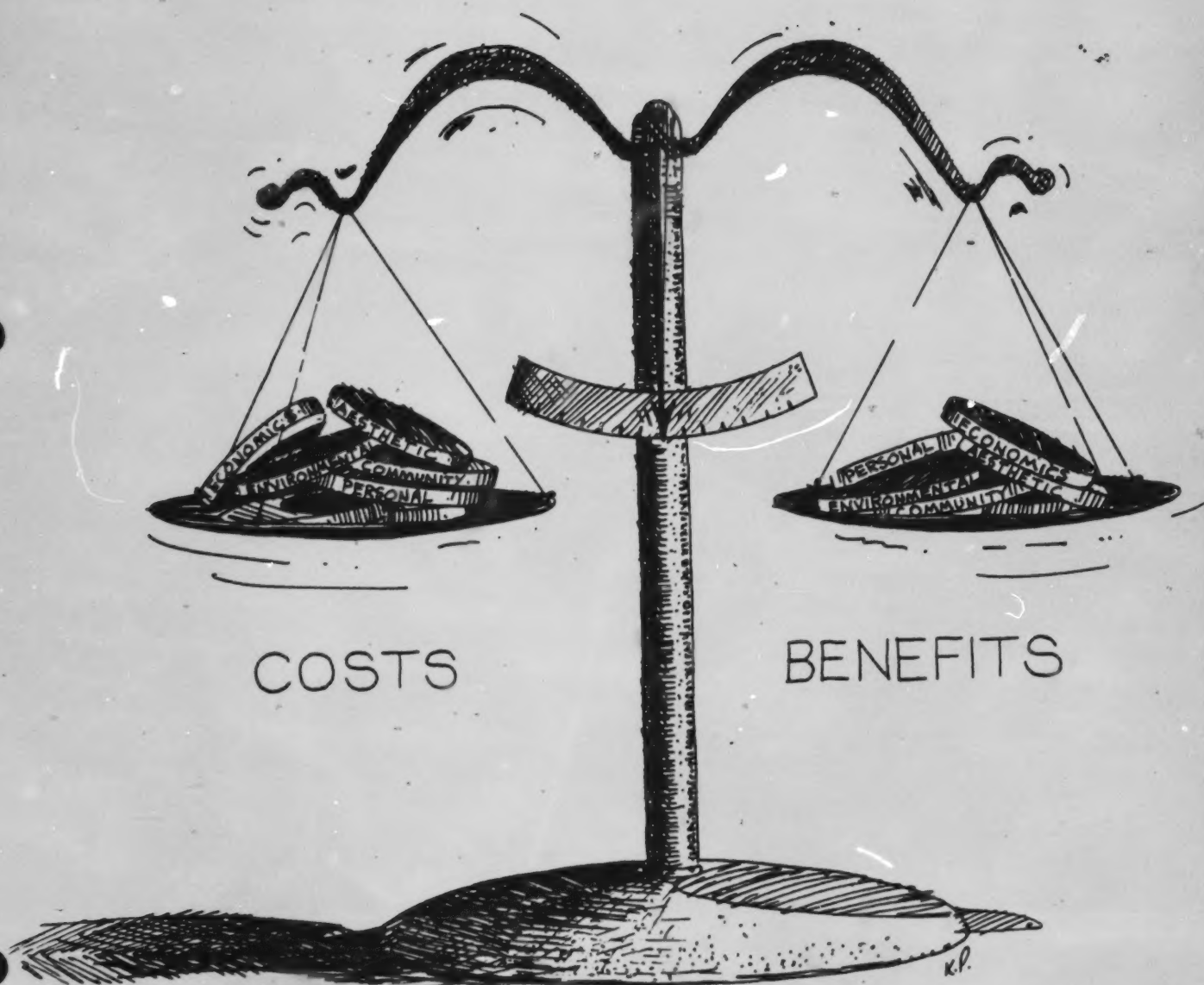


Figure 40. Exterior Window or Door Treatment.

ECONOMICS, TECHNOLOGY, and CULTURE



ECONOMICS, TECHNOLOGY AND CULTURE

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ECONOMICS, TECHNOLOGY, and CULTURE

The Environmental Education Act Amendment explicitly includes the necessity for consideration of the relationships between the impacts of environmental, economic and social concerns. In this context, we can examine the development of cultures in terms of their technological and economic changes, in relation to their environmental resource base.

The history of humanity can be looked at in terms of energy, technology, and economics -- both the discovery of principles and the invention and marketing of tools designed to improve living and working conditions. This is particularly the case in industrialized cultures like the U.S., where notable periods of history have been characterized by events that were considered to be bridges to further development, such as the development of the steam engine, or the integrated electronic circuit. We can discern four major periods of cultural history, made distinct by the discovery of important principles or the invention of important tools and technologies. These periods are:

- hunter-gatherer society, in which the discovery of fire was made;
- agrarian society, in which the technology of cultivation made possible the first permanent social groupings;
- pre-industrial or advanced agrarian society, which includes the Middle Ages and the Renaissance, and the introduction of capitalism as a permanent social form; and
- industrial society, exemplified by the Industrial Revolution, which offered abundant opportunities in agriculture, transportation, and national industry.

Many observers consider that we are now beginning the fifth period, a post-industrial society, where we look to alternative technologies and changes in economic growth patterns.

TECHNOLOGY

Sciences and technological advancements have made marked contributions in adapting the natural environments in which we live to social needs, by creating tools for shaping urban centers, agricultural systems, and information networks. The impacts of technological change have become important issues of public concern, as the often unforeseen and most unwanted effects become clearly evident. Some of these are direct, such as the obvious pollutions and general degradation of the environment.

Others are indirect social consequences, are more subtle, and therefore more difficult to measure. These are effects that arise from the societal adjustments required to accommodate and incorporate technological change. They include increasing dissatisfaction with education, business and government practices, and general changes in overall "quality of life." Many of these impacts are often directly attributed to "technology" itself, rather than to shifts in overall societal thought and goals.

An environmentally concerned public should be aware of two basic types of technological change. The first concerns the development of new technologies; the second involves the effects of new applications of existing technologies. In the context of environmental education, we can begin to understand the distinctions between those impacts directly caused by technology and those which have a deeper root in society. To do this, we can create a framework of information about the technology in question that is broken into two major areas:

1.) that which addresses the nature of the technology itself, its technical structure and function, and

2.) that which poses questions about the implications of the technology and its applications. This second category extends beyond the technical to the economic, political, social, and environmental consequences of technological impact

CONCLUSION

A systemic evaluation of economic and technological development -- past, present, and future -- must examine the relationships between technologies and political structure, law, economics, and social structures. This includes the "problems of success" caused by advances in technology and human ingenuity, which can be anticipated utilizing a holistic EE perspective. An environmentally literate citizen will understand these relationships and be able to apply this knowledge to the evaluation of economic, cultural and technological issues.

High School Energy/Environmental Education Training Model: Content Sourcebook prepared by Far West Laboratory for Education Research and Development, 1978 (Draft version)

334

The Price of Wheat

Curriculum Topic

NORTH AMERICA

Subject

Social Studies

Environmental Topic

ECONOMICS, TECHNOLOGY & CULTURE

Grade Level(s)

5-6

Site

Classroom

Skills

Listening, computing

Author

Paul Sanderson

Objective

The student will be able to:

1. participate in a game which simulates economics of wheat farming,
2. recognize that farmers do not control the prices they receive, but that the prices are determined by several variable factors.

To The Teacher

Wheat farmers are often at the mercy of the market place. They have some control over the number of crops they plant, fertilization and crop management, but they cannot be sure of the price return they will eventually receive at harvest time. Price is determined, in part, by supply and demand: amount harvested and need expressed by buyers. If demand is high, prices go up and the farmer profits. If demand is low, despite a full harvest, the farmer loses profits. Whatever, market conditions, the farmer must always pay his expenses. If he has a bad crop, he may lose money and go bankrupt, or at least into debt. A series of bad crops and/or bad prices can force the farmer out of business. This game-activity simulates some of the factors and problems farmers face in the wheat farming business.

Before You Begin

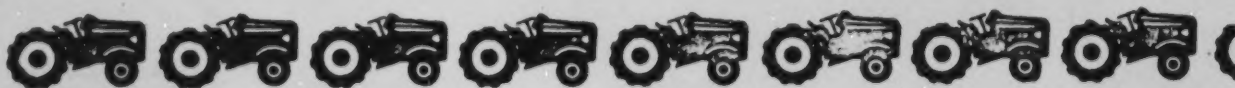
Preparation: Read the sheet "How to Play: Rules and Procedures".
Become familiar with the game.

Reproduce enough deeds, money, and expense tokens to
meet the needs of your class.

Materials: supply pencils and scratch paper
each player will need 1 die (can be taken from other
games [Yatzee has lots of dice])

Words To Know

market, supply and demand, drought, bumper crop, fertilizer, expense,
crop dusting, wheat, harvest, mortgage.



1959 - 8,266 FARMS



1972 - 4,500 FARMS

336

ACTIVITY

1. Explain that everyone in the class is going to become a wheat farmer, by playing a game. Some people will make money. Some won't.
2. Explain the rules of the game. Write a list of key rules on the blackboard. Choose a banker or play the role yourself.
3. Pass out the money with which each farmer will buy wheat seed and pay other expenses. Tokens are given in exchange as receipts of payment.
4. Play the game for 5 "seasons" or other predetermined length of time.
5. When the game is completed, discuss:
 - a. How many people made money? What helped you succeed?
 - b. How many people lost money? What caused you to fail?
 - c. What things can farmers depend upon? (Expenses, amount of crop planted, fertilizer.)
 - d. What things are the farmers not able to control? (crops die, the price of crops and weather conditions are variable.)
 - e. What determines a good or bad market? (supply and demand)
 - f. What determines demand? (price of flour, food, amount of money available for spending, crop failures in other places, surplus wheat)
 - g. Why would the government pay a farmer for not growing wheat? (to increase demand)

Related Activities

1. Play according to your own rules. Create new conditions and variables.
2. Investigate further the economics of wheat marketing. Consider the influence of American agriculture on world food sources.

Notes To Myself

STUDENT PAGE

HOW TO PLAY Rules and Procedures

At the beginning of the game:

Each player receives, from the banker, \$15 and a deed to a farm.
The game covers one season.

1. At the beginning of each round, each player must pay for expenses.

sack of wheat seed at \$1 per sack

farmhand pay \$2

crop dusting \$2

energy (gas, oil,
electricity, machine
up keep) \$2

fertilizer \$2

living expenses
(food, housing,
clothing, taxes,
schooling, trans-
portation) \$2

2. Each player must "plant" 5 sacks of wheat in the first season.
Thus expenses for the first round equal \$15.00 for every player.

3. Each player receives a token for every expense paid.

4. Each player rolls a die to determine harvest price:

harvest price is = # of wheat seed bags x role of die:

1 is a drought

2 is a crop failure

3 is a poor crop market

4 is an average crop market

5 is a good crop market

6 is a "bumper crop"

First season harvest income is, therefore, from \$5-\$30 depending upon the roll of the die.

5. Banker pays each player the harvest price determined by the roll of his die.

6. If a player rolls "1", he is bankrupt. He must return the deed, receive \$5, and join another farm with which he combines his assets.

7. If a player rolls "2" he can:

- a. miss a season's planting and receive a government subsidy of \$15. He must, however, spend \$10 for expenses for the season lost. Only one subsidy per farm per game; OR

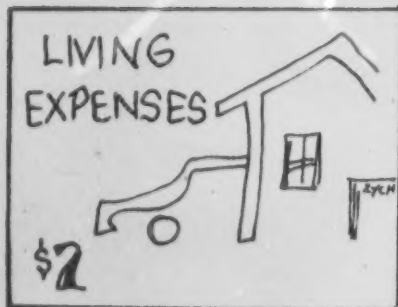
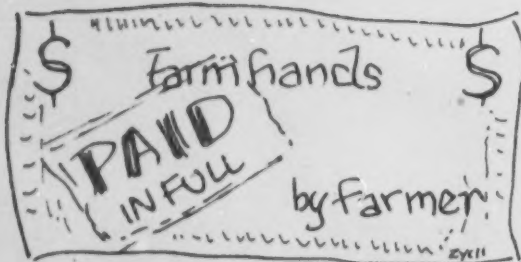
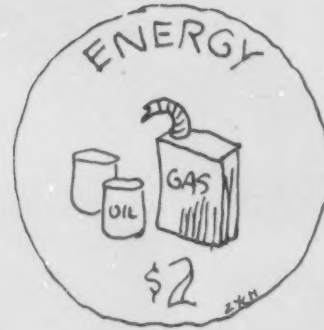
- b. mortgage the farm to the bank for \$15 and continue to play.
This farmer must pay \$8 to the bank on his next season

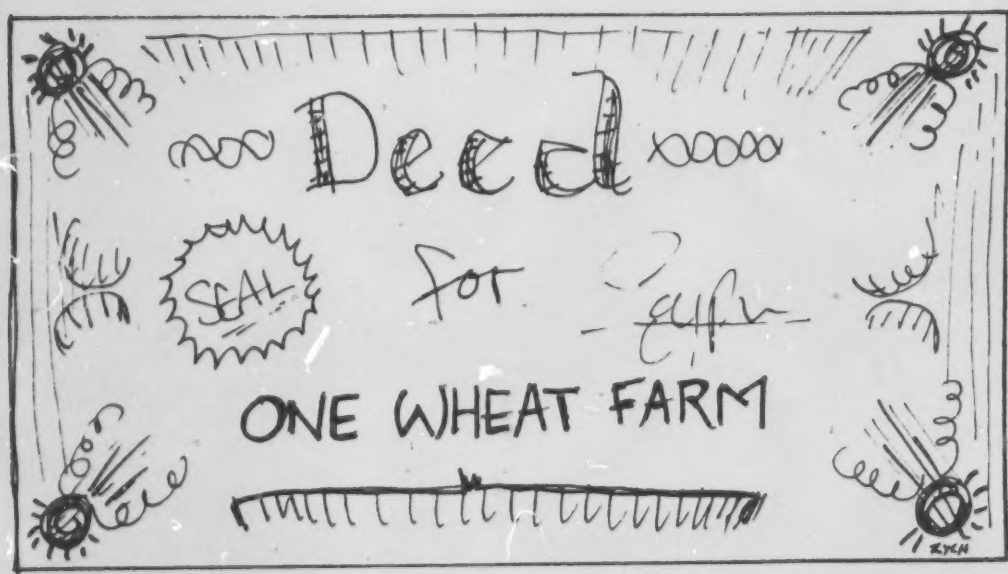
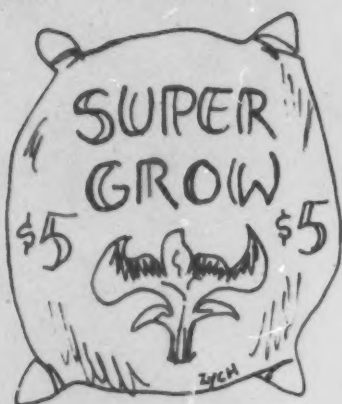
(\$5 principle, \$3 interest in order to pay off the loan.) Only one mortgage per farm per game.

8. A roll of "3" breaks even (profits cover expenses) and farmer may replant next season.
9. A roll of "4, 5 or 6" the farmer may replant for the next season and invest \$5 in "Super Grow" fertilizer which doubles (2x) harvest prices on rolls of 4, 5 or 6 in the next harvest. "Super Grow" does not help a roll of 1 or 2. Only one "Super Grow" per season.
10. After each season's harvest has been determined by the roll of the die, all deals (mortgages, purchases, etc.) are made with the banker and expense tokens collected.
11. Start the next planting season.

SUPPLEMENTARY

1. A player is bankrupt when he cannot cover expenses and plant wheat (at least one bag of seed). \$11 dollars is necessary, after profits, mortgages, subsidies have been counted. (Remember: When a player goes bankrupt, he receives \$5 for the deed, and may join another farm.)
2. A farmer may buy less than 5 bags of seed after the first season, but he must buy at least 1 bag (per season) while he is in active play.
3. A rich farmer may buy a bankrupt farm from the bank for \$25, and can then play more than one according to the rules of the game.
4. A player can mortgage, or go on subsidy whenever the situation necessitates, but only once each game per farm.
5. Play continues for 5 planting seasons, or 30 minutes.
6. The "winner" will be the farmer with the most money at the completion of the game.





Chocolate Bar World

Curriculum Topic

FOREIGN RELATIONS

Subject

Social Studies

Environmental Topic

ECONOMICS, TECHNOLOGY & CULTURE
No country is entirely self-sufficient in its supply of natural resources. Resources must be considered, therefore, as a global rather than a national concern.

Grade Level(s)

6-8

Site

Classroom

Skills

Role playing, interpreting data, cause and effect

Author

Thomas J. Kotulski

Objective

The student will be able to:

1. analyze interconnections of nations in the production of familiar products: in this instance, the chocolate bar.

To The Teacher

The goal of this activity is to make students aware that one of the major features of modern societies is their increasing interdependence upon one another. Society, from the family unit to the global patchwork of nation states, is composed of a complex series of systems and subsystems.

Such knowledge can help children to an understanding of what it means to live in a modern world, being made aware that what happens in one place affects what happens in others. Pollution, for example, does not recognize the sovereignty of nations, and, similarly, a strike in Detroit affects not that city alone. Most parts of our economic system are connected with other very different economic systems throughout the world.

Before You Begin

Materials: Most of this activity will be in the form of a discussion for which you will need a world map.

Words To Know

interdependence, sovereignty



Credit

Drawing: Cecelia Zych

Notes To Myself

ACTIVITY

1. Organize your student into 7 groups.
2. Announce to these groups that they are going to consider a very simple item: a chocolate bar.
3. Now ask them to think of a small town where most of the people earn their living working in a candy factory (Hershey, Pennsylvania). Appoint one group to represent Hershey, PA.
4. Ask the groups what else goes into a chocolate bar (Have a candy wrapper near by if you get stuck.) [Answers: sugar, chocolate, nuts, coconut, corn syrup]
5. Now identify on a world map where these items come from:
 - chocolate - from cacao seed cultivated in Central Africa. Appoint a group to represent Africans who grow and sell the seeds.
 - sugar - from the Carribbean Islands. Assign a group to represent sugar interests.
 - coconut - from the South Pacific. Assign a group to represent coconut interests.
 - corn syrup - from the corn fields of Iowa. Assign a fifth group to represent suppliers from this area.
 - nuts - from Brazil. Assign another group to lobby as representatives of Brazil.

Assign the final group to represent the Pacific Northwest; where lumber from which paper wrappers are made is grown.
6. Now describe the following events and ask each group what the impact of the event would be on their interests and how they would react:
 - a. A drought in the Midwest damages the yearly corn crop. Corn syrup then becomes difficult to obtain.
 - b. A good advertising campaign urges a tremendous number of people to buy the chocolate bars.
 - c. A tropical storm destroys the coconut crop in the South Pacific.
 - d. A revolution on one of the Carribbean Islands cuts off the supply of sugar.
 - e. War in Central Africa interrupts cacao exports.
 - f. The workers in a candy factory go on strike for higher wages.
7. Emphasize throughout, the idea of interconnections which relate all these groups despite the distances which separate them.
8. Ask the class to consider solutions to the problems effected by these events. How fair to how many parties can these solutions be?

Related Activities

Select a city or other working "system" and discuss its parts and their interrelationships.

Energy Menu

Curriculum Topic

ECONOMICS

Subject

Social Studies,
Home Economics

Environmental Topic

ECONOMICS, TECHNOLOGY & CULTURE

Grade Level(s)

7,8

Site

Classroom

Skills

Analyzing information,
identifying alternatives,
identifying consequences of
alternatives

Author

Pat Perrella

Objective

Students will be able to:

1. contrast the equivalent energy costs of different foods.
2. List how wise food choices can save energy.

To The Teacher

The American food industry depends on large quantities of energy to produce, process, transport, store, and prepare enormous varieties of foods. As a result the nation is running up an "energy deficit".

In 1910 the energy content of food produced in the U.S. was slightly greater than the energy used to grow, process and transport the food. In 1970, however, nine times as much energy was used by the food system than was contained in the food consumed. In other words, by the time the food gets to the dinner table, the total amount of energy already used is many times the energy contained in the food itself.

Several things can be done by the consumer who wishes to conserve energy and thus reduce this energy deficit. The use of energy to produce food lies in the manufacturing and transporting of fertilizer, the manufacturing process itself, maintaining and operating farm equipment. The more steps in the process, the more energy that is consumed by the product. One effort to reduce the number of "energy steps" is to eat vegetable protein rather than animal protein.

Other methods of conservation include choosing fresh foods over foods preserved by canning or especially freezing, which requires a great deal of energy. Products should be chosen which do not have an excessive amount of packaging. Cutting down on disposable containers and purchasing in bulk will save energy. Finally, planning shopping trips to coincide with other necessary errands would eliminate another energy consuming step.

In this activity students will be asked to examine their food preferences comparing energy cost and supermarket cost. They may be surprised to discover that low energy cost items are not always the most economical. For example, fresh string beans, because of higher demand, cost more than most brands of frozen string beans.

Before You Begin

Materials: Each student will need a copy of the directions, the Energy Menu, Energy Price List, pencil

Words To Know

energy cost, bulk

ACTIVITY

1. Pass out Student Worksheets to each student.
2. Supervise activity and lead discussion after activity is completed.
3. Questions for discussion:
 - a. Why would all of us benefit by selecting foods on the basis of their energy cost?
 - b. If you were to select items from Column 1 again, would your choices be any different?
 - c. How difficult would it be for you to select foods that have lower energy costs even if they might not be your first preference? Is it worth the energy savings?
 - d. Are low energy cost foods always lower in price at the supermarket? Can you offer any explanations?

Related Activities

1. You might want to discuss with students other low energy cost food items and plan a day's or a week's menu keeping energy cost as your main consideration.

Resources

"Energy Conservation in the Home", An Energy Education/Conservation Curriculum Guide for Home Economics Teachers, University of Tennessee Environment Center and College of Home Economics, 1977

STUDENT PAGE

DIRECTIONS FOR STUDENT:

1. READ THE MENU AND CHOOSE ITEMS BASED ONLY ON YOUR LIKES AND DISLIKES. INDICATE YOUR CHOICE IN COLUMN 1.
2. NOW USING THE SAME MENU, TRY TO SELECT THE ITEMS THAT WOULD TAKE THE LEAST ENERGY TO PRODUCE. THE ENERGY COST OF A FOOD INCLUDES FERTILIZERS, INSECTICIDES, EQUIPMENT, TRANSPORTATION, PROCESSING, PACKAGING, AND PREPARATION. PLACE A CHECK AFTER THE LOWEST ENERGY ITEM ACCORDING TO YOUR ESTIMATION IN COLUMN 2.
3. EXAMINE THE ENERGY PRICE LIST TO FIND EACH ITEM'S ACTUAL ENERGY COST. INDICATE ON YOUR MENU THE PRICE OF EACH ITEM YOU SELECTED IN COLUMN 1 AND ADD UP YOUR TOTAL BILL.
4. NOW FILL IN THE PRICE OF EACH ITEM THAT YOU SELECTED IN COLUMN 2 AND ADD UP THE TOTAL BILL.
5. TO DISCOVER HOW MUCH ENERGY YOU SAVED BY CONSIDERING THE ENERGY COST, CALCULATE THE DIFFERENCE BETWEEN THE TWO TOTALS.
6. AS AN OUTSIDE PROJECT, TAKE THE ENERGY PRICE LIST TO YOUR LOCAL MARKET AND WRITE DOWN ITS SUPERMARKET COST NEXT TO ITS ENERGY COST.

ENERGY MENU

	<u>Likes and Dislikes</u>		<u>Least Energy</u>	
	check here	energy cost	check here	energy cost
<u>Appetizers</u> (choose one from each pair)				
Frozen Juice				
Fresh Juice				
Crackers unwrapped (available in bulk)				
Crackers wrapped individually, packed in small cartons				
Butter				
Margarine				
<u>Main Dish</u> (please make a first and second choice)				
Luncheon Meat				
Chicken				
Turkey				
Rue with vegetables				
Beef (grass-fed)				
Beef (grain fed)				
<u>Vegetables</u> (we have only carrots, but choose the type you like)				
Fresh Carrots				
Dehydrated Carrots				
Frozen Carrots				
Canned Carrots				
<u>Drink</u> (please indicate two choices)				
Soft drink in aluminum cans				
Soft drink in returnable glass bottle				
Milk				
Beer in aluminum can				
Beer in glass bottle				
<u>Dessert</u> (choose one)				
Apples (fresh from the nearby orchard)				
Apples (store-bought)				
Shelled walnuts				
Unshelled walnuts				
Ice Cream				
TOTAL BILL				
Difference in energy cost:				
		348		

ENERGY PRICE LIST-1978

(Prices are proportional to actual energy used)

Appetizers

Explanation

Fresh Juice	\$.12
Frozen Juice	.40
Unwrapped Cracker	.10
Wrapped Cracker	.15

Freezing and processing use a large amount of energy.
Food wrapped individually or in small packages uses more energy than food that is unwrapped and available in bulk (large quantities).

Butter	.15
Margarine	.05

Main Dish

Luncheon Meat	1.60
Chicken	.96
Turkey	1.06
Rice & Vegetable	.45
Beef (grass-fed)	1.48
Beef (grain-fed)	2.08

A pound of meat requires about four times the energy to produce and market as a pound of vegetable protein.

Vegetable

Fresh Carrots	.12
Dehydrated Carrots	.92
Frozen Carrots	.31
Canned Carrots	.23

Processed vegetables require more energy than fresh vegetables. Freezing and dehydration requires large amounts of energy.

Drinks

Soft drink (aluminum can)	.45
Soft drink (returnable bottle)	.31
Milk	.34
Beer (aluminum can)	.50
Beer (returnable bottle)	.25

Disposable containers consume more energy than containers that are recycled.

Dessert

Orchard apple	.03
Store-bought apple	.19
Shelled walnuts	1.04
Unshelled walnuts	.39
Ice Cream	.60

Locally grown apple saves transportation.

Freezing is required

Saving Through Carpool Participation

Curriculum Topic

ECONOMICS

Subject

Social Studies

Environmental Topic

ECONOMICS & TECHNOLOGY - CULTURE

Grade Level(s)

8

Site

Home and Classroom

Skills

Computing

Author

Paul Kubicza

Objective

The student will be able to:

1. calculate the achievable financial savings of participating in a carpool.

To The Teacher

In 1978, approximately 58 million American workers traveled via automobile each day to and from work. Of this group, forty million American workers drove alone. With this many commuters driving an average of 94 miles per week, 290 million gallons of gasoline are consumed. Commuting constitutes the largest single category of automobile usage today.

Carpools provide an efficient mode of transportation while conserving resources and money. Incentives for participation in a carpool include toll discounts, company organized carpools, and special express lanes for multi-passenger vehicles.

The cost of driving an automobile is the result of many factors including depreciation, repairs, maintenance, parts, tires, gasoline, oil, insurance, federal taxes, state taxes, parking costs and highway tolls.

This activity will allow the student to examine the cost of driving a car and to calculate the savings gained through participation in a carpool.

Before You Begin

Preparation: Prepare classroom copies of:

1. The Cost of Driving a Car
2. How to Compute Commuting Costs
3. Commuting Costs Worksheet

Words To Know

carpooling, depreciation, maintenance, accessories



"Judging from the amount of noxious gases it emits, I'd say it's some type of weapon."

Conservation News 2-15-78

ACTIVITY

1. Distribute copies of "The Cost of Driving a Car" to the class.
2. Calculate the cost per mile of driving a car by adding the expenses of depreciation, maintenance, accessories, parts and tires, gas, oil, insurance, and taxes.
3. Distribute copies of "How to Compute Commuting Costs" to the class. Calculate an example with the class.
4. Distribute copies of "Commuting Costs Worksheet". Allow students to take the worksheet home to determine their parent's commuting costs. (This assignment may require several days if parents have never calculated the distance to work before.) For students with non-working parents, calculate the distance to a hypothetical site.
5. Complete the activity by examining the savings provided by a carpool. Below are sample discussion questions:
 - a. Is a carpool a desirable way to save money?
 - b. What are some of the problems in organizing a carpool?
 - c. What are the problems members of a carpool may experience?
 - d. Is a carpool beneficial to our economy?
 - e. What effects do carpools have on air pollution and gasoline consumption?

Related Activities

1. Students may write to the U.S. Department of Transportation or Connecticut Department of Transportation for information on carpool participation.
2. Students may determine the cost of traveling to the grocery store, beach, gas station, movies, relatives' or friends' houses, etc.
3. Discuss the effects of inflation and increasing energy costs on the cost of driving a car. Determine the annual savings per person of carpool participation.

Resources

"1977 Gas Mileage Guide", U.S. Environmental Protection Agency, Washington, DC.

"Save by Carpooling", American Lung Association,

Credit

"Gas Watchers Guide", American Automobile Association, Falls Church, VA.

"Ideas and Activities for Teaching Energy Conservation: Grades 7-12" Environment Center, University of Tennessee, 1977, EEC #1196,2.

STUDENT PAGE

HOW TO COMPUTE COMMUTING COSTS

EXAMPLE: FIGURE THE COMMUTING COSTS OF A STANDARD SIZED CAR TRAVELING 30 MILES ROUND TRIP TO A WORK SITE.

1. MULTIPLY COST PER MILE X MILES PER DAY: $.17 \times 30 = \$5.10$
2. ADD DAILY PARKING AND TOLLS $= +0$
3. TOTAL DAILY COST $= \$5.10$
4. MULTIPLY BY WORKING DAYS IN A MONTH $\times 20$
5. COST PER MONTH TO DRIVE ALONE $= \$102$
6. DIVIDE BY NUMBER OF PEOPLE IN CARPOOL $\div 4$
7. INDIVIDUAL COST BY CARPOOLING $= \$25.50$
8. MONTHLY CARPOOL SAVING $(\$102 - \$25.50) = \$76.50$

COMMUTING COSTS WORKSHEET

1. MULTIPLY $\frac{\text{COST PER MILE}}{\text{COST PER MILE}} \times \frac{\text{MILES PER DAY}}{\text{MILES PER DAY}} = \$$
2. ADD $\frac{\text{PARKING COST}}{\text{PARKING COST}} + \frac{\text{TOLLS}}{\text{TOLLS}} + \$$
3. TOTAL DAILY COST $= \$$
4. MULTIPLY BY WORK DAYS PER MONTH $\times$
5. COST PER MONTH TO DRIVE ALONE $= \$$
6. DIVIDE BY NUMBER OF PEOPLE IN CARPOOL $\div$
7. INDIVIDUAL COST OF CARPOOLING $= \$$
8. MONTHLY CARPOOL SAVINGS (#5 - #7) $= \$$

THE COST OF DRIVING A CAR (PER MILE) 1978

<u>Car Size</u>	<u>Depreciation</u>	<u>Maintenance, Accessories, Parts, Tires</u>	<u>Gas, Oil</u>	<u>Insurance</u>	<u>State and Federal Taxes</u>	<u>Total Cost (Per Mile)</u>
Standard	4.5¢	3.7¢	5.5¢	1.7¢	1.6¢	= 17¢
Intermediate	4.2¢	3.4¢	5.3¢	1.6¢	1.5¢	= 16¢
Compact	2.9¢	2.7¢	4.7¢	1.5¢	1.2¢	= 13¢
Subcompact	2.3¢	2.5¢	3.8¢	1.5¢	0.9¢	= 11¢

"You Can't Judge a Book by its Cover"

Curriculum Topic

ECONOMICS

Subject

Social Science

Environmental Topic

ECONOMICS-TECHNOLOGY-CULTURE

Grade Level(s)

6 - 8

Site

Classroom and Home Assignment

Skills

Obtaining and organizing
information, computing

Author

Orah Elron

Objective

Students will be able to:

1. calculate relative prices of food products,
2. compare prices of elaborately wrapped food to simple black and white wrapped products,
3. compare price of local food that reaches the table directly from the farm to the price of those products that undergo a long industrial process.

To The Teacher

In this activity students will be asked to give attention to the extent that wrappings have in the cost of our food products. Students can look at the problem from several different angles:

a. They can compare the beautifully wrapped products available in the supermarkets to those local products that are sold by roadside markets or in small shops directly from the farmer. In this case they will find that, by avoiding the wrapping and transportation of agricultural products, fresh and relatively cheaper food can be obtained, but at the same time the variety of fruit and vegetables and other food will be greatly limited by seasonal changes. The food supply of other less technologically advanced countries depends to a large extent on the seasonal availability of agricultural products and wrapping plays a small part in the cost of food. In the past, in this country too, food reached the table almost directly from the local farm, without any particular wrapping.

b. A second possible approach to the problem would be the comparison of prices of differently wrapped food: students would have to compare the cost of containers with beautiful pictures to those cans and cardboard boxes that use only black printing (Valu Time Division Topco Ass. Skokie IL) They also would figure the relative prices of large and small containers. In this case the focus would be on the economical and environmental problem - how much do we pay for the cardboard paper, plastic and colored printing in addition to the cost of the actual food we buy?

At the conclusion of these activities students will find that modern food industry enables us to obtain a large variety of different foods that reach us after a long chain of industrial processes. This food industry makes it easier to prepare a meal but adds much to the cost of the product. Students will also see that our modern food industry adds a heavy burden on the environment, since the amount of paper, plastic, cans and glass we have to throw away daily amounts to an enormous quantity of solid waste that needs to be disposed of by each town or community. Could the burden of this waste disposal be eased in any way by biodegradable wrappings or recycling ?

Do not expect exact mathematical results from this activity or right answers. The activity mainly will motivate the students to think about product packaging and thus influence their attitude as consumers of the future.

Words To Know

producer, consumer



"When you're finished, can I have the empty bottle?"

ACTIVITY

1. Ask students to collect as many wrappings of food and household foods as they can (These should be cleaned so as not to attract flies and dirty the school). Ask students particularly to collect very pretty wrappings and the simple black and white ones that have come to several food markets by Valu Time Division Topco Ass., Skokie IL. Students can do this researching directly in the food stores.
2. Students should compare the prices of foods in different containers so as to learn as much as possible about the price of the wrapping as part of the whole product (see To the Teacher).
3. Students will keep records of all their findings.
4. In the classroom students will compare and combine their information working in small groups of 4-5. They might be given printed questionnaires to help them to conclude their research.
5. Groups will present their information to the class, and the class will discuss the results and conclusions.
6. Discussion Questions:
 - a. How big is the part of the wrapping in the prices of the food and household goods that you have checked?
 - b. Could we avoid part of this cost? Is it desirable to avoid it? Have you any ideas about it?
 - c. What influence has our food industry and particularly the way we wrap our food had on the environment? (The preparation of the wrappings for the marketing and the disposal of used wrappings, cans, paper and plastics.)
 - d. How did grocery stores look in grandmother's time?
 - e. How do they look in other countries? South America, Europe, Africa?
 - f. Is there any student in the class that has seen different stores in other parts of the world and can tell us about them?
 - g. Can we give any advice to the shopper, how to obtain the best food value for the money?

Related Activities

See also "Where Does Our Food Come From" in this volume.

In Worester, MA on Shrewbury Street there is a department store, Spague's, that sells anything without wrapping for much lower prices.

Resources

Halperin, Meryan and Orah Elron, "Man and His Environment", "Matal", Science in the Elementary School, Tel-Aviv University, 1973.

A Wise Commercial

Curriculum Topic

SCIENTIFIC METHOD, ECONOMICS

Subject

Social Science

Environmental Topic

ECONOMICS

Grade Level(s)

7-8

Skills

Constructing hypothesis
evaluating information

Site

Classroom

Author

Maryann Cronin Horgan

Objective

Students will be able to:

1. identify the steps of the scientific method used in a controlled experiment.
2. discriminate between a validly-tested product and one which has not been tested under controlled conditions.

To The Teacher

Most science disciplines teach the scientific method. This activity can be used to reinforce learning the steps of the scientific method:

problem
hypothesis
controlled experiment
results gathered (data)
analysis
conclusion

This activity is designed to urge students to see a correspondence between the emphasis on setting up well-controlled experiments such as they know in science class and the need for reasonable questioning and logical testing in the lives they live as consumers.

Old magazines from the school library or from home can be cut up and glued to construction paper, with a written evaluation of the advertisement attached to it below. A car ad, for example, may say "Highest mileage rating of any mid-sized car." Students should ask, "Where is the control?" and eventually use the Scientific Method to design an experiment for testing the mileage claim. It should be easy to find advertisements which reflect environmental issues: Ads for oil companies, car size, spray deodorants, etc.

The activity can be done as a homework assignment. In class, discussion should be generated readily as students share and analyze television commercials they choose for this purpose. They should quickly see the difference between a well controlled experiment and a clever skit used to entice the consumer.

Before You Begin

old magazines, scissors, construction paper, glue

Words To Know

scientific method, inquiry, hypothesis, control, variable, consumer

ACTIVITY

1. Have each student bring in a magazine or newspaper advertisement that makes a specific claim about a product. (e.g. highest EPA mileage, lowest tar and nicotine) Encourage a distribution of the types of ads. You may want to have several old magazines available as backup supply.
2. Instruct each student to cut out an ad and paste on a large piece of construction paper.
3. Ask the student to write, beneath each ad, the claim the manufacturer makes about his product. This will serve as a problem statement.
4. Ask the student if there are any controls included in the ad. It will probably be necessary to discuss what a "good control" for an experiment is. If no control is present, discuss with the class what might have been an appropriate one.
5. Have each student design an experiment to prove or disprove the manufacturer's claim in the ad. Remind them to include the appropriate controls they have themselves designed.
6. Have several students describe and discuss their experimental designs. As a class, work to improve exemplary experimental designs of several students.
7. For homework, assign students to select five ads from different media - radio, TV, newspaper, magazine, etc. For each ad have the student identify the claim, and design an experiment to prove or disprove the ad's contention.

Industrialization & Urban Growth

Curriculum Topic

URBAN STUDIES

Subject

Social Studies

Environmental Topic

ECONOMICS AND TECHNOLOGY -
CULTURE POPULATION

Grade Level(s)

7 - 8

Site

Classroom

Skills

Reading, constructing hypothesis

Author

Paul Kubicza

Objective

The student will be able to:

1. form hypothesis explaining how the auto industry might have effected population growth in urban areas.
2. compare the average annual earning of workers in rural and urban areas.

To The Teacher

Most cities today are overpopulated. This heavy concentration of people puts a strain on energy, resources, water sources, sewer systems and space. In 1790 only 7% of the U.S. population lived in cities. In 1970 73 per cent of the U.S. population had moved to the cities and only 27% remained in rural areas.

Between 1860 and 1900 American urban areas grew twice as fast as the total population. This urbanization was a world-wide phenomenon intimately associated with industrialization. Industrial cities developed essentially around a factory, a steamship, or a railroad. Once established, these cities grew by a self-generating process.

Numerous social, economical, and political facilities were developed to serve the working people: housing projects, banks and insurance companies, docks and warehouses. These in turn attracted more industry and the need for more workers. This activity will focus on the development of one industry, the auto industry, and its possible effect on population growth in the urban areas.

Before You Begin

Preparation: prepare class copies of: Springboard #1 (The Rise of the Auto Industry); Springboard #2 (Average Annual Earnings in Manufacturing and Farm Labor 1890-1926)

Words To Know

assembly line, population, industry, urban, rural



"Which would you rather see built on this site?
(A) An intercontinental jetport; (B) an atomic
powerplant; (C) a mall-type shopping center; or
(D) a 3,000-unit middle-income housing development."

Conservation News 2-1-74

ACTIVITY

1. Distribute copies of Springboard #1 (The Rise of the Auto Industry).
2. Have students take turns reading the article orally.
3. Discuss the article with class. The following questions may be of value:
 - A. What were some advantages of Ford's assembly line process?
 - B. Why do you think the price of the Model T dropped from \$850 in 1908 to \$290 in 1924?
 - C. Until 1927 Henry Ford only produced one car model in one color only. Why would he do this?
 - D. If you were Henry Ford, in what type of city would you want to build your factory? Why?
 - E. From where would the workers for his factories come? Why?
 - F. What other businesses might develop in Detroit because of the automobile industry? Explain.
 - G. How would the development of these industries and businesses affect population growth? Why?
4. Pass out copies of Springboard #2 (Annual Average Earnings in Manufacturing and Farm Labor, 1890 - 1926).
5. Discuss with class. The following questions may be of value:
 - A. If you were a farmer during the period 1896 to 1926, would you like to move to the city to work in industry? Why or why not?
 - B. Do you think many farmers moved to the city? Who would stay behind and why?

Related Activities

1. Use the "Graphic Summary of the United States Population (see resources) to trace the growth of urban areas and decline of rural population.
2. Discuss the results of having a very large population in a small area as is found in cities. What effect does a large city population have on pollution?
3. Discuss how suburban areas are growing and why.
4. Predict what will happen to American cities in the future.
5. Discuss the importance of a census.

Resources

Boughey, A., Man and the Environment, MacMillan Company, 1972, pp. 161-167. "Graphic Summary of the United States Population", U.S. Census bureau, 1970.

Credit

"Industries, Cities, and People," Resource Material Development: Population Dynamics In Eighth Grade American History, Florida State University, 1974, EEC #148.

Notes To Myself



1750



TODAY

STUDENT PAGE

The famous
F O R D
M O D E L T
Yours for less than
\$ 3 0 0
Be the first on your
block to travel in
comfort and luxury.
Drive through the
twentieth century in
Henry Ford's finest
invention!

THE RISE OF THE AUTO INDUSTRY

Many people wanted to build cars. A young man named Henry Ford built one of the first successful ones. A friend of Ford's described the day in 1896 when his first car actually ran:

I have heard from him and Mrs. Ford the story of the last forty-eight hours that he worked on that first car. Forty-eight hours without sleep. The second night Mrs. Ford sat up waiting the outcome of his efforts. The machine was nearing completion. Would it run? It was about 2 A.M. when he came in from the little shop that stood in the rear of the house. The car was finished and ready for a try-out. It was raining. Mrs. Ford threw a cloak over her shoulders and followed him to the shop. He rolled the little car out into the alley, started it, mounted the seat and drove off. The car went a short distance and stopped. The trouble was a minor one. The nut of a bolt had come off. It seems that there was some vibration in that first machine....

The problem was corrected and the car was a success. Ford and other men soon were building cars for sale.

Henry Ford was interested in making cars for average Americans. So he designed a car that was cheap, but sturdy. He concentrated on only one model of car— in only one color. It was called the Model T or "Tin Lizzie."

Henry Ford developed an assembly line. First he made each worker responsible for only one job in putting together a car. Then he speeded up the process by carrying the cars to the workers on a moving belt. As each car passed, each man added his part. The the car continued to the next man. This speed of production was so great that the Ford Company "boasted that

raw iron ore at the docks at eight Monday morning could be marketed as a complete Ford car on Wednesday noon, allowing fifteen hours for shipment."

Henry Ford's system of the assembly line so reduced costs that he could drop the cost of his car. He offered the Model T for \$850 in 1908, \$540 in 1914, and \$290 in 1924. Altogether, Ford produced 15,000,000 Model T's before changes in public taste forced him to close down his factories and design a new model in 1927.

Adapted from: Goldshlag, Patricia, Ed.,
et al. Many Americans - One Nation.
New York: Noble and Noble, 1974.

AVERAGE ANNUAL EARNINGS IN MANUFACTURING AND
FARM LABOR 1890 - 1926

<u>Year</u>	<u>Manufacturing</u>	<u>Farm Labor</u>
1896	\$ 406	\$220
1901	\$ 456	\$255
1906	\$ 506	\$315
1911	\$ 537	\$338
1916	\$ 651	\$388
1921	\$1,180	\$522
1926	\$1,309	\$593

Adapted from: U.S. Bureau of the Census.
Historical Statistics of the United
States, Colonial Times to 1957.
Washington, D. C., 1960.

"We in Europe . . ."

Curriculum Topic

EUROPE

Subject

Social Studies

Environmental Topic

ENERGY-RESOURCES

Grade Level(s)

7-8

Site

Classroom

Skills

Locating, obtaining, communicating, evaluating information and using it for a purpose; listening with comprehension; choosing freely, developing self-confidence

Author

Steve Gold

Objective

Students will be able to:

1. locate information about nuclear energy.
2. critically evaluate presentations for and against expanding use of nuclear power.
3. state differences between the energy situation of the United States and Europe.

To The Teacher

Energy independence is a matter of concern in this country, but we in America do not perceive the same level of urgency as Europeans do. Europe is as dependent upon energy as the United States and even more dependent upon imports. Oil, petroleum products and natural gas represent 61 percent of Europe's energy supply in 1970; almost all of that total was imported, a situation unlikely to change until large scale development of North Sea resources begins. Oil price increases are felt much more keenly in Europe than they are in the United States.

Europeans are therefore engaged in a frantic race to reduce dependence on foreign oil by finding alternative energy sources. Coal is unacceptable because Europe already thoroughly exploits its coal resources. Most European officials feel solar energy is not only too distant a possibility but is also too land-consuming for the crowded continent. But the Europeans are not giving up hope. "En France on n'a pas de petrole, mais on a des idees", is the optimistic French slogan -- in France we have no oil, but we have ideas. The idea France, as well as most of Europe, is turning to is nuclear power. As one official of the Common Market stated, "In the U.S., you may be operating under the illusion that you have many options. We in Europe can see no way to go without nuclear power."

The increase of nuclear power production in the U.S. is somewhat stalled. In 1977, 70 American reactors produced 12 percent of the nation's electricity. This is considerably higher than it was five years ago, but is lower than the predictions of many nuclear advocates had been. A number of factors contribute to the slow rate of growth of nuclear energy in this country. One is the rising price of uranium and a growing feeling that nuclear energy may not be as good a buy as was once thought. Another is a complex and tedious regulatory process which results in building times for plants that are twice as long as those in Europe. Entrenched environmentalists oppose the construction of nearly every plant and, as the Seabrook case shows, can cost a utility millions of dollars even if the plant is eventually constructed.

The environmentalist opponents of nuclear power voice legitimate concerns. One is that the plants' release of small levels of radiation during ordinary use may cause increased rates of cancer and infant mortality. (Much of the documentation in support of this claim has been questioned). Another is that the plants are unsafe. While no nuclear plant can explode like a bomb, if the coolant water which constantly surrounds the reactor core were to be lost due to a pipe break or other accident and the emergency cooling system failed to operate quickly enough, the reactor could overheat, causing a thermal explosion which might breach the reactor's containment vessel and permit spewing of large amounts of radioactive material over large areas with almost incalculable loss of life, health, and property. Opponents are even more concerned about the intensely radioactive wastes which are produced in the plants. Most experts admit that no permanent way has yet been devised to store these wastes, which remain deadly for thousands of years after their initial production. Environmentalists are particularly concerned about the breeder reactor, which -- if it worked -- would produce more energy than it consumes. They fear that the breeder is particularly susceptible to accidents because of its liquid metal coolant, and that the plutonium produced in such reactors could be stolen by terrorists or diverted to foreign governments, after which producing a crude nuclear explosive is a surprisingly easy task.

Europe's environmentalists have not been silent on these matters. Indeed, there is a growing and violent opposition to nuclear power which includes radical elements of the political spectrum as well as environmentalists. Urged on by the slogan originated in Germany, "Better active today than radioactive tomorrow", activists have blocked plants in West Germany, France and Italy. The Flowers Report, issued by a blue-ribbon commission, stopped dead -- although perhaps only tempo-

rarily -- British development of nuclear reprocessing capacity while the matter was subjected to public debate. But in spite of all the opposition, Europe's leaders continue to pursue the nuclear option with vigor. Still, estimates are that nuclear energy will provide only 7 per cent of total energy used in Europe by 1985, much less than earlier goals of 13 percent. (These figures are not strictly comparable to the statistic given above for the U.S., which was a percentage of electricity produced.) But by that date investment in the European atomic power is estimated to be one hundred billion dollars. France hopes that by then 2/3 of her electricity can be produced in nuclear plants.

Germany, the United Kingdom, Italy and other European nations have more modest but still ambitious goals. And in all four of the countries named, breeder reactor research is far ahead of the United States. Each of those nations has at least one small experimental breeder already in operation, and plans for large scale commercialization; the U.S. experimental breeder at Clinch River, TN is still in the planning stage and has received major setbacks from the Carter administration.

Energy decisions will be among the most important that must be made in the rest of this century. The OPEC embargo and our subsequent political difficulties with economically strapped European allies and Japan demonstrate clearly that energy is a global issue. While national interest may predominate energy decision making, no single nation can make rational energy policy without being aware of the dilemmas and problems which confront other nations. This activity is designed to give students an opportunity to think about the energy situation from a more global and less provincially American point of view.

Before You Begin

Preparation: You might wish to do some additional reading about nuclear power or the formats and strategies of debate. Suggestions are included in the Resources section. Make copies of the Information Sheet for each student.

Words To Know

nuclear, atomic, radiation, radioactive waste, meltdown, electric generating capacity, reactor, breeder, fission, loss of coolant accident

ACTIVITY

1. Distribute the student Information Sheet to the class.
2. After a brief discussion about the information sheet, survey the class' feelings about increased nuclear power. Then select or accept as volunteers eight students to debate the resolution: Resolved, that the European Economic Community should act to greatly increase its nuclear generating capacity. Have four defend the affirmative, representing European energy administrators concerned about future supplies for their nations. Have four argue the negative, representing American environmentalists concerned about the dangers of nuclear power production.
3. Give the students about a week to research and prepare their cases. A bibliography has been included for them, but the teacher should emphasize that they should use their creative juices to go beyond it. Be sure to assist students with their research as needed. Also make the format of the debate clear at the outset.
4. Hold the debate. The ordinary format for academic debate is as follows:

1st Affirmative Constructive Speech....8 minutes
1st Negative Constructive Speech.....8 minutes
2nd Affirmative Constructive Speech....8 minutes
2nd Negative Constructive Speech.....8 minutes
1st Negative Rebuttal Speech.....4 minutes
1st Affirmative Rebuttal Speech.....4 minutes
2nd Negative Rebuttal Speech.....4 minutes
2nd Affirmative Rebuttal Speech.....4 minutes

Feel free to reduce speech lengths, so long as two basic rules -- equal speaking time for each team and the affirmative going first and last -- are observed. Each student should do one speech. The following suggested speaker duties will, if observed, avoid boring duplication of remarks:

1st A.C. should concentrate on why Europe feels nuclear energy is needed -- the absence of alternatives, high oil prices, etc.

1st N.C. should attack the safety of nuclear plants.

2nd A.C. should defend safety precautions.

2nd N.C. should reply to the earlier 1st A.C. speech, stressing alternative energy sources. Each rebuttalist should then try to rebuild the position stated in the constructive speech of the same number. The last two rebuttalists may also summarize their sides' overall position.

5. When the formal speeches are over, have a short challenge period in which each team can pose direct questions to the other concerning matters brought up in the debate. Then allow time for the class to ask questions of the debaters, preferably in the same class period. After the discussion, survey the class again. Was either team successful in changing opinions?

Related Activities

1. Instead of holding a debate, have the class write essays explaining their positions, after suitable research.
2. Modify the debate format to include a European anti-nuclear and an American pro-nuclear position.
3. Visit a nuclear plant in your area and ask about the safety precautions taken.
4. Write critical reports on books about nuclear energy.
5. Collect information about your local utility's nuclear and alternative energy policies.
6. Take the class to a hospital or a physics lab to discover some of the non-energy uses of nuclear radiation.

Resources

The literature about nuclear energy is vast. A skimming of your library's card catalog or the Reader's Guide to Periodical Literature will immediately prove rewarding. Here are some particularly useful references:

American Assembly, The Nuclear Power Controversy, Prentice-Hall, 1977. Thoughtfully pro-nuclear.

Berger, John J., Nuclear Power: The Unviable Option, Ramparts Press, 1977. Advocates alternatives.

Hammond, Allen, et al, Energy and The Future, American Association for The Advancement of Science, 1973.

Novick, Sheldon, The Careless Atom, Houghton-Mifflin, 1969. Old but classic introduction to the concerns about nuclear safety.

Schmidt, Fred and David Bodansky, The Fight Over Nuclear Power, Albion 1977. Nuclear phusicists defending their bread and butter.

Periodicals which frequently have articles about nuclear power include: United States News and World Report, Environment, Bulletin of the Atomic Scientists, Science, Science Digest. These have a variety of viewpoints.

Information may be obtained in favor of nuclear power from the Atomic Industrial Forum in New York and most utility companies. Most environmental groups disseminate anti-nuclear information, especially the Clamshell Alliance, Boston. Many magazine articles are listed on the Student Information Sheet.

A good book about debate, with research, organization, and speaking suggestions is:

Wood, Roy V., Strategic Debate, National Textbook Company, 1968.

Credit

The quotation in To The Teacher is by Leonard Williams, in U.S. News and World Report, July 11, 1977, p. 52.

STUDENT PAGE

STUDENT INFORMATION SHEET NUCLEAR POWER IN EUROPE AND THE U.S.

One of the ways in which electricity can be made is by turning turbines with steam. To boil water to make the steam requires large amounts of heat. Some power plants use nuclear power, the stored energy in atoms of uranium and some other elements, to produce this heat.

In the United States we hear much about an "energy crisis". One problem is that the price of oil we must buy from other nations is skyrocketing. To reduce our dependence on foreign oil, many people agree, we must develop other energy sources. One of the most talked about sources is nuclear power. Today, nuclear power generates 12 percent of our electricity.

But nuclear power is in some trouble in this country. Strict safety rules and opposition from people concerned about the environment are making it very difficult to build new plants. The opponents of nuclear power are concerned that an accident might occur in such a plant which could kill thousands of people, even though the plants can not blow up like an atom bomb. They are also worried about the deadly radioactive wastes produced in nuclear reactors, which no one is sure how to store. Finally, they are concerned that the planned breeder reactor, which produces plutonium fuel that can be used to make bombs, is especially unsafe.

Many people in Europe share these concerns. However, their governments feel that European nations must develop nuclear power anyway. Unlike the United States, which has much coal, land for solar energy, and even oil of its own, most European leaders claim that Europe has no option except nuclear energy. Consequently, European nations are engaged in large nuclear building programs. Already several of them have small breeder reactors, while the American breeder has not yet been built.

The European nations also export their nuclear technology to other lands. President Carter, concerned that spreading atomic knowledge might also lead to spreading atomic weapons, has been involved with heated disputes over nuclear power policies with our European allies. It is clear that energy policy will be a major part of our relations with Europe for years to come. It is important for all American citizens to be well informed about energy issues and choices. Would you like to find out more about nuclear energy in the United States and Europe? Here are some magazine articles to read to help you get started:

U.S. News and World Report, July 11, 1977, p. 52

U.S. News and World Report, May 29, 1978, p. 37.

Saturday Review, January 22, 1977, pp. 6, 14, 19, 24, 26, 28.

Time, May 25, 1977, p. 48.

Intellect, December 1975, p. 211.

Environment, June 1975, p. 8.

Environment, December, 1972, p. 2

Pack Your Bag

Curriculum Topic

GEOGRAPHY

Subject

Social Studies

Environmental Topic

ECONOMICS, TECHNOLOGY
AND CULTURE

Grade Level(s)

6-8

Skills

Locating and obtaining information
using information for a purpose
reading maps

Site

Home and classroom work

Author

Orah Elron

Objective

The student will be able to:

1. collect information about countries with help of atlas and library
2. use collected information to plan an expedition

To The Teacher

Throughout history man has learned to live in almost every part of the globe. By supplying the needed food, clothes and shelter man adapted his lifestyle to even the most extreme conditions of climate. While in former times only rare expeditions reached distant places and little information about these travels reached those who stayed home, today we all have a great deal of information about the most remote areas of our earth. Modern communicational devices, radio, TV and film, bring information to everyone and traveling in our own times becomes constantly easier and more frequent.

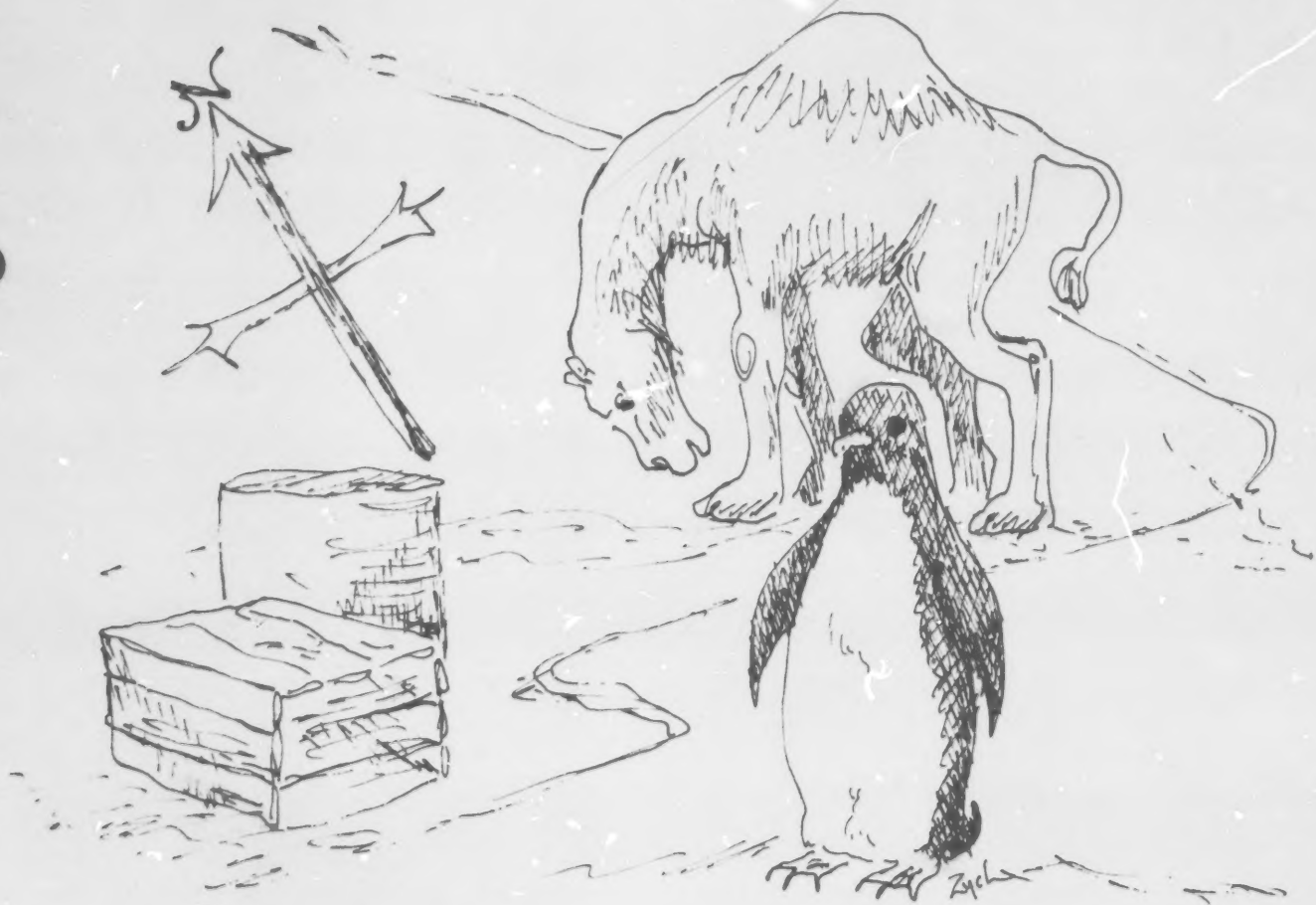
But the connection between the information from TV and film to geography learned in school is often missing. Young students seldom give thought to life in another place, different climate and landscape, different living conditions.

In this activity students are asked to visualize living conditions in distant places that are very different from their everyday surroundings: the South Pole, the Himalaya Mountains, the Sahara Desert, the Amazon River, the Kilimanjaro Mountain, Scandinavia or a village below the surface of the ocean. Actual information about these places can be found in geography books or atlases.

Before You Begin

Should the activity be done in the classroom it would be advisable to work in small groups. It will also be necessary to obtain encyclopedias or geography books about the particular countries and an atlas for every group of students. Time needed: at least a double period (1½ hours).

The activity can also be used as individual home projects. The students would have to use library material for their information.



ACTIVITY

1. The students, in small groups of 3-6 will choose among seven condition - cards (these follow) which trip they want to join. They should then prepare for each particular trip by writing down each item and the quantity of it. Stress that only the written equipment will be at their disposal. (As in a real expedition, if you forget the salt you will have to eat without it...)

The main aim of this activity is to illustrate to the students that we are very dependent on our environment, its resources and conditions. Many circumstances children take for granted in their everyday life might prove a problem under different life conditions (for example, water in the desert).

2. Activity Cards: for the students (it would be nice to illustrate each card)

A. You have decided to join an expedition to the Antarctic. Your companions are in charge of the scientific equipment, so that this will not be your concern. But you have to prepare a list of the necessary equipment, transportation, clothes, shelter and food that your expedition might need during one month in the extreme conditions of this continent. There will be 10 people on this trip. Write what you will need, and how much of each item you wish to take. Don't forget even the smallest detail.

B. You have decided to join a new group of mountaineers that intend to climb the "roof of the earth," Mount Everest, in the Himalayas. When dividing the tasks of preparations you are given charge of the final most important 4 days: 5 of you will climb from the last, highest camp to the very top of the mountain! What will you take in your backpacks? Write each item and how much of it is needed for the five climbers.

C. You join a jeep-expedition that decided to cross the Sahara Desert from North to South. You are in charge of the equipment for 4 people in one jeep during one whole week. Only what you take with you will be there, for at no other stops on the way will you find any other supplies! Be careful not to overload the jeep! How much of each item will you pack? How will you pack it, what containers will you use?

D. A friend invited you and your friend to join a scientific research trip along the river Amazon. Two of you will join the group at the Brazilian airfield, Manaus, and travel downstream in a boat. At Obidos (350 miles downstream) you will be picked up by a ship and taken to the big airfield in Belem on Brazil's east coast to the Atlantic. What will the two of you take for the trip - (including food?) Write every item and the quantity you think you will need. You will be able to fill your water containers at Manaus.

E. Three of you, you with two friends leave Nairobi to Moshi in Northern Tanzania to join a hiking trip for climbing Mount Kilimajaro in one week. You want to see the external snow at the equator! What will the three of you need for a whole week? You do not have to carry all of it on your back; part of it will be taken by native carriers. Write every item and its quantity in details. It might become cold when you near the glaciers. (Find the height of the mountain's two peaks.)

F. You and three of your friends want to tour Scandinavia for the month of August. Your parents paid the air trip to Hamburg and Kiel at the north of Germany. You intend to leave from Kiel and hope to reach the Arctic Circle somehow. What will you take with you for one month? You intend to buy food on your way.

You may carry up to 40 pounds in the airplane, but don't forget that you will be on the road for a whole month. Don't take too much, but neither too little! How much money will you take with you? In what way will you take it? Consider the foreign currencies and their dollar value.

G. You are invited to visit the "village with no sun" that Jacques Yves Cousteau built below the surface of the ocean. You will stay below the surface for 3 days. What will you take with you in the boat? Write any details you can think of!

3. Every one of the seven groups will tell about their preparations for the trip. What do all have in common? (water, food, clothes) In which way are they different? (The divers need air, so does the group that climbs Everest.) Will the group to the Kilimanjaro need air? Which groups need drinking water? Can the rest of the class add provisions that the group members forgot? Are the preparations sufficient?

Related Activities

1. The students might suggest writing a report after the trip. What have we seen? What unexpected adventures did we have?

2. It is also possible to revise the activity, and to travel to different parts of the USA. What have you seen there?

Resources

Elron, Orah, and Amelia Terkel, "The World Around Us", Matal (Science for Elementary School, Tel Aviv University), 1974.

Credit

Drawing: Cecelia Zych

Early American Barns

Curriculum Topic

CULTURE, COLONIAL PERIOD,
ART, DRAFTING - The early New
England barn is a unique example
of American architecture

Environmental Topic

TECHNOLOGY AND CULTURE
The relationship between man
and his natural environment is
mediated by his culture

Skills

Information skills
constructing models

Subject

Social Studies

Grade Level(s)

8

Site

Classroom

Author

Maryann Horgan

Objective

The students will be able to:

1. draw a barn of the colonial period and its floor plan,
2. investigate the history and architectural history of early American barns.
3. recognize and cite evidence for the harmony that existed between nature and the materials and design used by the colonists in the building of their barns.

To The Teacher

Early American barns are an excellent example of Colonial American architecture. They reflect an agrarian era in which new materials were used and the barns made much larger than earlier European models: symbols of the American dream! Standard American barn design is credited to both Pennsylvania and New England. There was a similarity of design because these early barns were built to fit similar landscapes and farming needs. Pine, for example, is light and does not decay so it was used for the floors and outside walls. Oak on the other hand, is very hard, so it was used for the framing. As land was cleared, the stones were used, without mortar, for the foundation. Because of the severe New England winters, the steep thatched roofs of European design were abandoned for the gable style with cedar shingles.

Pine trees were left around the barn because their needles provided insulation on the roof. The traditional red barn color was from a blend of natural elements: red oxide + skim milk + lime. Prevailing winds always determined the positioning of the building. Today, many barns still have their weathervanes, although ornate vanes are probably a newer addition. One fine example of a structure well adapted to land and weather conditions is the Saltbox. The long, slanted roof faces north. In the winter this roof would be packed with hay and leaves and later with snow to provide insulation.

Function governed design, as in Nature itself. Barns which were originally simple in design, began to change as their purposes changed. Two storied barns appeared, for example, in the 18th century, when farmers began to house plow animals on the ground floor. Similarly, silos for holding fodder made their appearance.

With the energy crisis looming and fuel bills soaring, it would be helpful if modern architects and builders would follow the tradition of the early barn builders and consider harmony with nature, the land and weather, in addition to their desire to produce a work of art.

Before You Begin

Preparation: Research materials on barns (See Resources)
art materials
Research Question Sheet

Words To Know

pioneer, colonist, design, architecture, harmony, adaptation, shingles, silo, cupolas, gable, gambrel



ACTIVITY

Part I - Action Oriented

Imagining themselves to be early colonists, students will draw first the the floor plan and then the exterior of a barn they intend to build on their farm. All spaces in the drawing should be labelled according to use. (e.g. cows, grain, etc.) Ask students to evaluate their drawings:

- a. Is your barn appropriate in size, shape and color to its natural setting?
- b. Is your barn well oriented to weather conditions?
- c. Is your barn built of the best materials?
- d. Does the barn's function govern its design?

Part II - Research Oriented

Using information obtained from reference books or from visits to barns, students should be able to offer responses to the questions provided here on the Research Question Sheet.

Related Activities

1. Visit a barn in your town and talk to the owner about it's history.
2. Make a collection of photographs or drawings of different barns in your town.
3. Draw "hex signs" and find out why they are on barns.
4. Read about, or visit, the round Shaker Barn in Hancock, MA.

Resources

Arthur, Eric and D. Whitney Dudley, Barn; New York Graphic Society, New York, 1972.

Klamkin, Charles, Barns, Their History, Preservation, and Restoration; Hawthorne Books, Inc. New York, 1973.

Sloane, Eric, American Barns and Covered Bridges; Wilfred Funk Inc., New York, 1954.

Sloane, Eric, A Museum of Early American Tools, Ballantine Books, New York, 1964.

Sloane, Eric, A Reverence for Wood, Ballantine Books, New York, 1965.

Sloane, Eric, An Age of Barns, Funk and Wagnalls, New York, 1966.

STUDENT PAGE

EARLY AMERICAN BARNS - RESEARCH QUESTIONS

1. Why did the colonists use many different woods in the construction of their barns? Give some examples.
2. What would be the most efficient way to build the foundation for the barn?
3. What facts must the colonists have considered before deciding to use cedar shingles for the barn roofs?
4. Was the Dutch gambrel roof an improvement over the simple gable roof? Why?
5. Did the early barns have windows? How could the problem of ventilation be solved?
6. Why were New England barns often painted red?
7. Why was the weather so important in the architecture and location of the barn?
8. Why do you think the early colonists developed the Saltbox design in their houses?
9. By the 19th Century, Americans were specializing in cash crops (tobacco, dairy products, etc.) how did this affect the design of the simple barn?
10. As a rural American culture evolved, it left it's mark on the barns. What are some examples of their cultural marks?



Conservation Heroes

Curriculum Topic

CAREER AWARENESS

Subject

Social Studies

Environmental Topic

ECONOMICS, TECHNOLOGY & CULTURE

Grade Level(s)

3-8

Site

Classroom

Skills

Locating and obtaining
information, using informa-
tion for a purpose

Author

Cyndi Walsh

Objective

The student will be able to:

1. identify conservation heroes of the past and present.

To The Teacher

Surrounded by abundance, Americans began only slowly to realize the need for conservation. To most people, limiting the use of resources was contrary to the American way of life. However, concern for conservation began with the protests of a few scientists and writers. It was these protestors who realized what could happen in areas where population, urbanization, and industry were expanding without concern for environmental impact.

During the rise of conservation as a national policy in the United States, concerned individuals led the way by awakening the American people to the need for care for the natural environment. Through individuals, whose writings and political efforts provoked and fostered effective governmental policy regarding the environment, Americans became interested in conservation. All of the major problems, issues and conflicts in the development of an enlightened attitude toward the land can be traced through these "conservation heroes."

Before You Begin

Materials: a variety of biographical materials, encyclopedias, National Geographic Index, conservation related periodicals, Audubon Magazine index.

Words To Know

conservation, hero, career



A Bill O'Malley cartoon

Conservation News 9-15-73

ACTIVITY

1. Ask your students to select a conservation hero (heroine) from the suggested list (attached) or find one of their own.
2. Assign research time for information collecting about the chosen individual or group. Librarian may be asked to assist in aiding the student's research. The students may be inclined to write letters to recommended groups and organizations for further information on particular individuals.
3. After information is collected, ask students to prepare a conservation Hall of Fame. Each exhibit should include some of the following:
 - a. Picture, drawing or photograph of the hero.
 - b. Time line of events - individual's accomplishments and failures.
 - c. An article of clothing the person might have worn.
 - d. An object that might have been treasured by this person.
 - e. A picture or diagram that tells about their greatest accomplishment.
 - f. Information card with an explanation of exhibit.
4. Ask students to make a small museum display on a board or in a box.
5. Set up Hall of Fame and allow time for presentation of chosen heroes.

Related Activities

1. Research the following clubs and organizations and prepare an exhibit of them. Write letters to determine their function and founders:
 - League of Women Voters of the U.S., 1730 M. Street, NW Washington, DC
 - National Audubon Society, 1522 K Street, NW, Washington, DC
 - National Wildlife Federation, 1412-16th Street, NW Washington, DC
 - Sierra Club, 1050 Mills Tower, San Francisco
 - National Assoc. of Soil and Water Conservation District
Vermont Avenue, NW, Washington, DC 20005
 - The Izaak Walton League of America, 2326 Wauekegan Road
Glenville, IL 60025
 - Garden Club of America, 598 Madison Avenue, NY 10022
 - The Conservation Foundation, 1250 Connecticut Avenue, NW
Washington, DC
 - The Urban Coalition, 2100 W Street, Washington, DC
 - The E. S. Environmental Protection Agency, Washington, DC 20037
2. Spend time interviewing a local environmental protector by letter, phone, in person. Find out about this person's life story, past experience, training ambitions, values. Write an editorial about this person and include in the environmental hall of fame.

3. Write an autobiography of you - an average American student who has decided to become a National hero as an environmental protector. In your life story include the major accomplishments that you will achieve in your lifetime and what national heroes have influenced you. (From: Environmental Law, Computer Based Resource Unit, NY State University)

Resources

Forte, I. and J. Mackenzie, Kids' Stuff, Incentive Publishers, 1976.

State University College at Buffalo, NY, Computer Based Resource Unit, Environmental Law: Obj. #33.

Notes To Myself

STUDENT PAGE

SUGGESTED LIST OF CONSERVATION HEROES

PETE SEEGER - MUSICAN, PROTEST SONG WRITER

GREEN PEACE - PORTEST GROUP ON WHALE KILLING

LADY BIRD JOHNSON - FORMER FIRST LADY OF THE UNITED STATES

JOHN MUIR - FOUNDER OF THE SIERRA CLUB

SENATOR GEORGE MCGOVERN - POWERFUL ADVOCATE OF ENVIRONMENTAL CONCERNS

JOSEPH SAS'S - PROFESSOR, AUTHOR OF THE BOOK DEFENDING THE ENVIRONMENT: A STRATEGY FOR CITIZEN ACTION, ALFRED A. KNOPF, 1971

JACQUE COUSTEAU - FRENCH NATURALIST

GIFFORD PICHARD

FREDRIC LAW OLSMESTAD

HENRY D. THOREAU - AUTHOR OF WALDEN'S POND

ERNEST HEMMINGWAY

THOMAS JEFFERSON

RUSSEL TRAIN

PRESIDENT TEDDY ROOSEVELT

TOM MCCALL - OREGON'S GOVERNOR, FORMER JOURNALIST, TV NEWSCASTER, DEFENDER OF ENVIRONMENTAL QUALITY - MAKING A MODEL STATE EXCELLENT ARTICLE IN AUDUBON MAGAZINE, SEPT. 1973 PP PP. 130-132.

JOHN BURROUGHS

BALANGER

Some Like It Cool

Curriculum Topic

THERMODYNAMICS

Subject

Science

Environmental Topic

TECHNOLOGY AND CULTURE

Grade Level(s)

7-8

Site

Classroom

Skills

Collecting, compiling and interpreting data

Author

Paul Kubicza

Objective

The student will be able to:

1. identify the direction of heat energy transfer between hot and cold environments.
2. classify a variety of common insulation materials

To The Teacher

Thirty percent of the national use of electricity during the summer consists of air-conditioning for homes and apartments. Power system overloads with brownouts and blackouts during very hot weather are increasingly likely. The relationship between keeping things cool and insulation is investigated in activities in which students try to prevent the melting of ice cubes. The desirability of insulating homes to use less electricity is examined through student experiments and classroom discussion.

There are three types of thermal insulation widely used in homes today. The first type consists of batts or blankets of mineral wool (this may be either fiberglass or rock wool) which comes in a variety of thicknesses and in several different widths. Second is loose fill, also made of mineral wool, which comes in bags so that it can be poured between attic beams or into hollow wall cavities. Third is urea formaldehyde foam which is pumped into attics and hollow wall cavities by franchised applicators.

Insulation efficiency is measured in R-values. The R-value of a substance is a measure of its thermal resistance. Seven inches of fiberglass insulation is an excellent insulator with an R-value of 19. One-half inch plywood is a poor insulator with an R-value of only 0.62. House walls should have insulation with an R-value of at least 13 (3-1/2 inches of insulation), and ceilings should have insulation with an R-value of at least 19.

One of the laws of thermodynamics is that warm things have more heat energy than cold things, and when a warm thing is placed near or around a cold thing, some of that heat energy is transferred or flows to the cold thing. By wrapping or enclosing the ice cube in this activity, students slow down the transfer of some of the heat energy in the room to the ice cube. The results of the game indicate that some materials can slow down the transfer of heat energy more than others. These materials are called insulators.

Before You Begin

Materials: approximately equal-size ice cubes (1 per student and teacher)

plastic bags (small sandwich bags to hold ice cubes and water)

insulating materials (collect as many as possible):

- paper-various thicknesses
- cardboard-different types and thicknesses
- styrofoam coffee cups
- paper cups
- glass tumblers or beakers
- metal cups or cans
- plastic food containers
- transparent food wrap
- wax paper
- newspaper
- foam rubber
- vermiculite
- sand
- small wooden containers
- cotton balls
- different types of cloth (wool, cotton, nylon, fake fur, etc.)
- anything else you can think of

Note: Average size ice cubes take approximately 2 hours to melt. The lab takes 10-15 minutes to start. If your schedule does not give you this much time, you can use the small sized ice cubes that are about 1 cm. across.

Preparation: Prepare classroom copies of "Insulating Materials In the Home."

Words To Know

heat flow, insulator, R-value

ACTIVITY

1. Inform students that you have collected some materials for an interesting game that anyone can play. Tell the class that each team of students will be given an ice cube and the goal of the game is to prevent the ice cube from melting for the longest time possible.
2. Show the class the materials that can be used. Have each group gather the material they will use to try to preserve the ice cube. Encourage groups to choose different materials and means of wrapping. (Note: If time is limited you may stop the activity here and continue with Step 3 the next day.)
3. Give each group an ice cube in a plastic bag. Have them wrap the bag with the materials they selected.
4. As a control place 1 ice cube in a plastic bag where all students can see it. Be sure to record its dimensions (in cm) before you start. This is necessary since some groups may bury or cover their bag and the cube will not be visible.
5. The control ice cube will be used as a timer. When it is almost completely melted the game ends. This takes from 1/2 to 2 hours depending on the size of your ice cubes.
6. When the timer ice cube is almost melted signalling the end of the game, have all student retrieve their ice cubes and measure them in cm. Avoid touching the ice cubes.
7. Compare the class results. You can put a chart on the board or overhead projector and record the results as follows:

<u>Group</u>	<u>Insulating Material</u>	<u>Size of Cube at End of Game</u>
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The following questions may be of value in analyzing the results:

- a. How long did it take the timer ice cube to melt?
 - b. Were any ice cubes still unmelted?
 - c. Which materials were best at preserving the ice cube?
 - d. Did the thickness of the material make any difference?
 - e. Why did the ice cubes melt?
 - f. Which materials slowed down the transfer of heat toward the ice cube more than others?
 - g. Define insulator. Ask which materials are the best insulators? the poorest insulators?
 - h. Why is home insulation vital during a hot summer?
 - i. What type of materials would make the best home insulators?
8. Pass out copies of "Insulating Materials In the Home." Discuss the meaning of R-values. Discuss which material would preserve the ice cube the longest. Relate the thickness of insulation to R-value.

Related Activities

1. Discuss examples in which insulation is used to keep things cold.
2. Have students bring milk cartons to class. Conduct a game in which students try to find the best way to insulate their house (the milk carton). Use an ice cube and various insulating materials.
3. Discuss how a thermos bottle keeps a liquid cold.
4. Have students make up a list of good insulators and a list of bad insulators.
5. Discuss the following question: "Why does insulation that keeps a home cool in summer also keep it warm in the winter?"

Resources

Abraham, N., Balch, P., Chaney, D., and L., Rohrbaugh, Interaction of Matter and Energy, Rand McNally, 1973, p 272-273.

Heimler, C., and J. Price, Heat, Light and Sound, Merril Publishing Company, 1977, p 5-9.

Credit

Smith, S., ed. Energy-Environment Mini-Unit Guide, National Science Teachers Association, 1975, p 101-106, EEC #744.1.

"Ideas and Activities for Teaching Energy Conservation", Environment Center, University of Tennessee, 1977, EEC #1196.2.

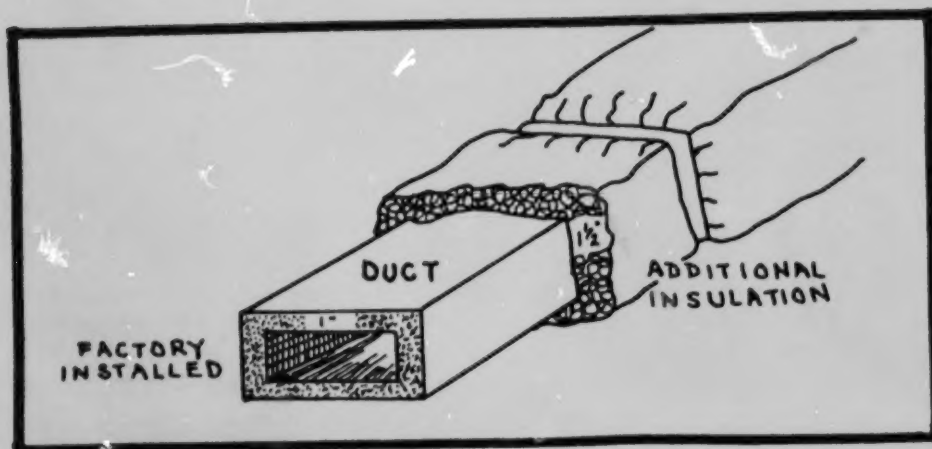
Notes To Myself

STUDENT PAGE

INSULATING MATERIALS IN THE HOME

<u>MATERIAL</u>	<u>R-VALUE</u>
1. $\frac{1}{2}$ INCH GYPSUM BOARD	0.45
2. $\frac{1}{2}$ INCH PLYWOOD	0.62
3. COMMON BRICK, PER INCH THICKNESS	0.20
4. FLOOR TILES	0.05
5. CARPET AND FIBER PAD	2.08
6. CARPET AND FOAM RUBBER PAD	1.23
7. $\frac{3}{8}$ INCH ROOF	0.33
8. 1 TO 4 INCHES OF AIR SPACE	1.00
9. 2 TO $2\frac{1}{2}$ INCHES OF INSULATION	7.00
10. 3 TO 4 INCHES OF INSULATION	11.00
11. 5 TO 7 INCHES OF INSULATION	19.00

THE R-VALUE IS A MEASURE OF THE RESISTANCE OF A MATERIAL TO HEAT FLOW. MATERIALS THAT HAVE HIGHER R-VALUES ARE BETTER INSULATORS.



Duct In-
sulation.

Sundials

Curriculum Topic

ASTRONOMY

Light from the sun can help us keep time.

Subject

Science

Environmental Topic

ECONOMICS, TECHNOLOGY & CULTURE

The growth of science and technology have increased our use of natural resources.

Grade Level(s)

4-5

Site

Classroom, sunny outdoor area

Skills

using information for a purpose

experimenting
constructing models

Author

Paul Sanderson

Objective

The student will be able to:

1. construct a working sundial
2. recognize that light energy can be converted by a simple technological device into a useful form for human use.

To The Teacher

The sundial was perhaps the earliest time piece, designed to measure the the passage of time in short segments by casting a shadow upon a circular face which indicated the movement of the sun's positioning. Before this invention, time was measured in the large segments of night, day and month. The first sundial was perhaps simply a stick in the ground. By trial and error, and later, with the aid of advancing science and technology, man was able to refine the sundial to a tool for precise measure. In addition to becoming more accurate and, thereby, more useful, they also became decorative objects.

The time of day can be determined by the position of the sun in relation to lines drawn on the dial. Tilt of the earth's axis is accounted for in the sundial's construction, so that the length of the day is determined by the month of the year. Lessons on these astronomical phenomena can be included in the use of the sundial you will make.

Before You Begin

Preparation: Read carefully the instructions included here for making and using a sundial. Build one in advance to acquaint yourself with its construction and function.

Materials: According to the enclosed instructions - enough for each student to make his/her own sundial, and copies of the instructions including worksheets for each student.

Caution: Never look directly at the sun. It can damage eyes permanently.

Words To Know

Astronomy, sundial, latitude

ACTIVITY

1. Ask your students at what time of day shadows are longest. shortest. In each case, why?
2. Explain that by making a simple instrument, you can tell the time of day by use of sun's light.
3. Pass out the instructions. Working together a step at a time, construct your "Pocket Sundials."
4. Experiment with your sundials, according to suggestions in the instructions. Use them early in the morning, at noon, and in the afternoon.
5. When these experiments have been completed, discuss results:
 - Did your sundial work?
 - How did it convert the sun's light into a useful form for us?
 - What time of day is your pocket sundial most accurate? Why?
 - When is it least accurate? Why?
 - Why do you use a "month" slit?
 - What are other ways in which the sun can be used beneficially without damage to the earth?
 - Why do we no longer use sundials? Would it be a good idea to use them again?

Related Activities

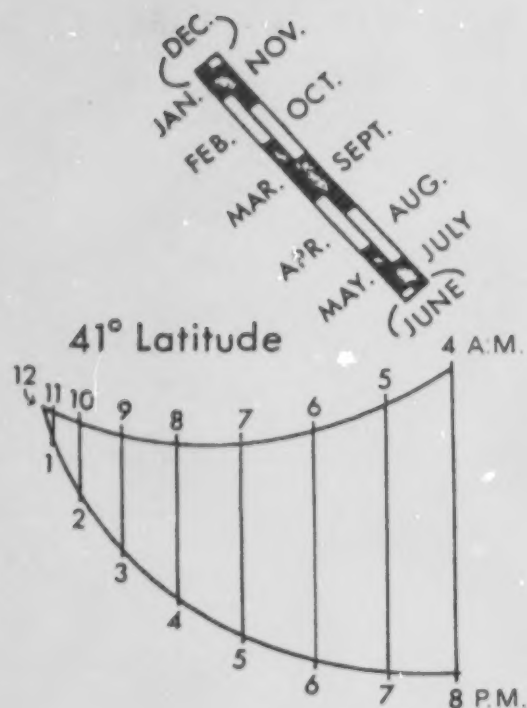
1. Learn how other astronomical phenomena such as planets, constellations & asteroids move in the sky, and how they change from hour to hour, day to day, month to month, year to year etc.
2. Visit a planetarium.
3. Research the history of the sundial.

Credit

The Curious Naturalist, Mass. Audubon Society, Jan., 1975. p 11.



A.



POCKET SUNDIAL

1. Move the thread along the "month" slit to the approximate date. (It must stay, or be held, where it is set.)
2. Adjust the bead so it is over the Noon Point when the thread is held gently taut from slit.
3. Hold the two halves of the card at right angle with the "dial" half in a vertical plane and orient it so that a ray of sunlight coming through the narrow aperture falls along the Sun Line.
4. With the weight hanging free the bead assumes a position among the hour lines. Estimates of time between hours can be to a ¼ hour or better except near noon. Forenoon times are read from the upper arc and afternoon times from the lower arc.

Fold

Weight
Pocket

A POCKET SUNDIAL

This simple sundial idea came from a type of sundial used in the seventeenth century. Although it is not an accurate timepiece, it will tell the time to within about 15 minutes, and it's fun to make and to use. Directions:

1. Cut out the rectangle (or a photocopy of it) along the colored line. Glue it onto medium thickness cardboard.
2. Cut out narrow black rectangle at end of sun line marked "slit". (Cut completely through card.)
3. Make a (razor) slit along the center line of month scale just equal to its length.
4. Score the cardboard along the fold line with a dull knife and fold printed faces together.
5. Paste or tape a piece of paper over the words "weight pocket"; put paste only along its edges

and bottom.

6. Pierce card at "A" and pull through a 9" long thread with a knot at one end so that Knot fetches up against inside face. Bring free end back through card at month slit. Reeve a small bead onto the thread, looping thread once around, and then tie a penny-size washer (or other FLAT weight) at its free end. The "weight pocket" will hold the washer when sundial is not in use.

The dotted lines above and below the Sun Line indicate how you can adjust the sundial for your latitude: if your location is north of 41°, draw your Sun Line above the one shown, adding to the angle indicated above this Sun Line as many degrees as you are above 41°. Draw your Sun Line below the one shown, if your location is south of 41°.

from: Ward's *Bulletin*, Jan. 1971.
published by Ward's Natural Science Est., Inc.

Energy Chain

Curriculum Topic

ENERGY GENERAL

Subject

Science

Environmental Topic

ECONOMICS, TECHNOLOGY - CULTURE

Grade Level(s)

6 - 8

Site

Classroom

Skills

Reading, interpreting data,
using information for a
purpose, brainstorming

Author

Ed Lisk

Objective

Students will be able to:

1. identify energy-related problems that they or their families might meet close to home.
2. relate these energy situations to the issues of population growth, production of goods and services, dependency on foreign oil supplies, concern for the environment, and changing lifestyles.
3. discuss possible solutions to energy problems.

To The Teacher

In this activity, students will be asked to identify a link in the energy chain which a hypothetical situation represents, then in small groups brainstorm the consequences of the problem and possible solutions.

To prepare you for the classroom discussion, the following is background information on each of the five situations.

Situation 1 sets up the hypothetical problem of how to cope with sudden and severe shortages of oil in the United States as a result of a stoppage of imports. Some experts predict that the national emergency we would face would be worse than any civilian crises faced in wartime. Industry could grind to a halt; stores, schools, hospitals could close; food shortages could quickly develop. The government might have to institute rationing and allocate available fuel to selected users. Have students suggest who should have top priority.

The second situation poses a problem that may be very familiar to your students - the crowded classroom. Here is population growth close at hand. Do students, in this situation, have a choice about their population growth? Will the larger class population create a need for more goods and services? Where will people sit? Perhaps the school will go into two sessions. Can the school system afford to pay the teachers overtime? How does an increased population affect energy use?

Students may want to move from this population problem to a discussion of the growing numbers of people all over the world--and particularly the emerging nations who require increasing energy resources for their developing technologies.

Situation 3 presents two issues in the delicate balance of environmental concern: the need for energy in urban areas and the desire to preserve the beauty and natural ecology of a wilderness recreational setting. Class members may want to debate which concern has priority. Is there a compromise?

Situation 4 points to the fact that the food production industry uses more than 12 percent of the nation's fuel budget. Increases in productivity per acre of land, in the use of farm machinery and food processing and preparation raise the rate of energy consumption. Students may be interested to learn that it takes the equivalent of a half-glass of diesel fuel to put one glass of milk on the table; two pounds of coal to produce a one-pound loaf of bread; three pounds of coal to produce one pound of hamburger. Farmers use almost as much fossil-fuel energy in the form of fertilizer as they do to operate all of their tractors.

Nearly twice as much energy is used to process foods - cutting, washing, cooking, canning, freezing, drying, packaging - as it took to grow it. Transportation, storage, refrigeration, and preparation of food in the kitchen takes twice as much again. Students might suggest some of these solutions: greater use of animal manure for fertilizer, more hand labor, the planting of home gardens, fewer processed and convenience foods, people eating more vegetable/grain products (lower on the food - energy chain than meats).

Accommodating ourselves to the less convenient mode of public transportation rather than private automobiles will require a real change in American lifestyle. Situation 5 deals with this issue. The entire transportation sector uses more than 40% of our energy budget.

The passenger car accounts for 21% of this. Fifty-six per cent of all commuters drive to work alone; only 14% use public transportation. Over half the land in many cities is devoted to roads, parking lots, garages, and service stations. Transportation energy use could be cut in half if commuters used buses instead of cars.

Before You Begin

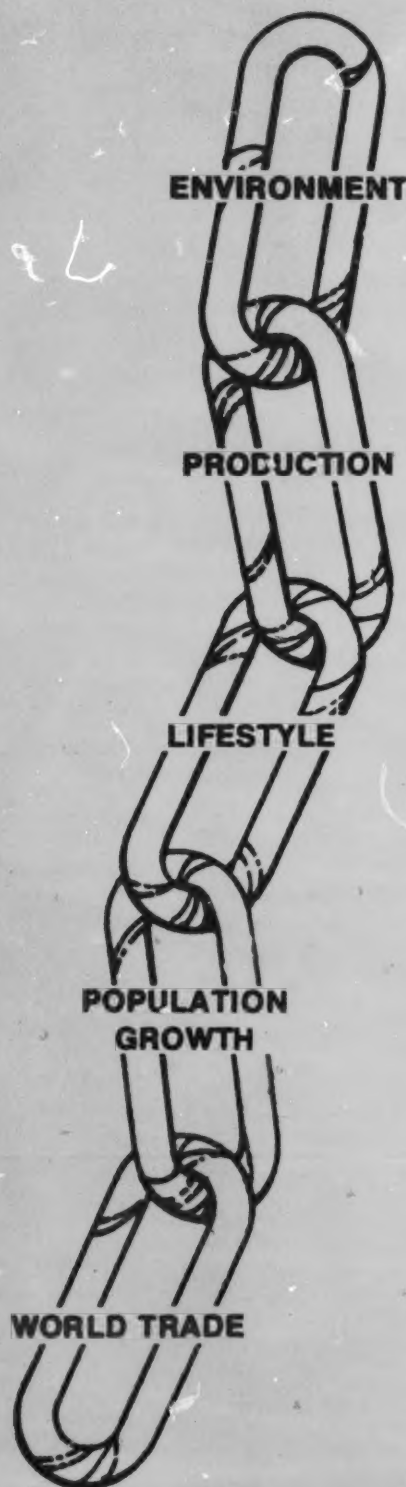
Duplicate student worksheet page.

Words To Know

lifestyle, production, interrelationship

STUDENT PAGE

The Energy Chain



Population growth, production of goods and services, dependency on foreign oil supplies, environmental health and safety, and the effect of these on our lifestyles—each of these is a link in the chain of energy use. Each is part of the energy challenge.

Draw a line from each short story to the appropriate link. Form small discussion groups. With others in your group, define the problem in the following situations and discuss what your solutions might be.

1. Time: One possible day in the future. Canada has decided to stop exporting oil. Some of the other oil-producing countries decide to band together and withhold oil in order to raise prices. U.S. supplies of oil are suddenly cut in half. There is no milk or bread in your house, no gas in the car, and you live 5 miles from the nearest store. What kinds of problems would you and your community face if there were a serious oil-shortage? How could you solve these problems?
2. Each year the number of students in your classroom increases. This means more seats in less space, more noise, less personal help from your teacher. A new business has opened in your town, employing 300 people. Suddenly, your class size has doubled. How will this affect you and your school?
3. A large utility company is planning to build an electric generating plant right where you and your family camp and fish every summer. The coal resources are nearby (mining hasn't started yet, though) and the city 500 miles away is desperately short of electric power. Should the plant be built? Why or why not?
4. Your uncle manages a large farm that produces many food products. He operates tractors and giant combines; he runs a gasoline-powered irrigation system, cow-milking machines and crop-drying equipment. He uses fertilizers made from petroleum. Because petroleum is scarce, his costs have more than doubled. If he cuts back on his use of petroleum-based products, he would seriously reduce food production per acre. Is there any way he can cut back on his reliance on petroleum? How can consumers help cut energy needs for food production?
5. The annual operating budget of your city (your public tax money) can pay for either completion of the super highway system or enlarging the suburb-to-city mass transportation system, but not both. Most commuters don't like to ride buses, so the buses are usually only half full. The vote is coming up at the council meeting next week. How should the council vote?

ACTIVITY

- 1.) Distribute student worksheet.
2. Have the student read the five paragraphs and draw a line to the appropriate link in the energy chain.
3. Form small discussion groups and direct students to define the problems in each of the paragraphs and discuss some of the possible solutions.
4. As a class, consider the following questions:
 - (a) Are any of the links in the energy chain more important than the others? If so explain how and why.
 - (b) Determine the role you and your fellow students play in each of the chain links.
 - (c) Considering our present environmental situation, which link in the chain can most easily be controlled?

Related Activities

1. Chart a product from production to consumption as it relates to the energy used.
2. Using the newspaper, keep a one week record of energy related stories and deduce their connections.

Resources

Clark, Wilson, Energy For Survival, Anchor Books, Garden City, N.Y., 1975.
Energy Primer, Portola Institute, Fricke-Parks Press, Fremont, Calif, 1975.

Credit

*This activity is based on "The Energy Challenge", Federal Energy Administration, EEC #1012.

Notes To Myself

No Place Like Home

Curriculum Topic

EARTH SCIENCE

Subject

Science

Environmental Topic

TECHNOLOGY - CULTURE

Grade Level(s)

7 - 8

Site

Classroom

Skills

Information skills
Defining problems
Developing a plan of action

Author

Pat Perrella

Objective

Given a limited amount of information, students will be able to: analyze the information and devise a plan to convert an underground structure into an energy efficient living unit.

To The Teacher

Many design and construction features exist which can be incorporated into residential structures to reduce their energy consumption. In order to conserve energy, maximum use should be made of natural means to produce a healthful and livable home environment with minimum use of mechanical equipment for climate control. A primary consideration is the site. An underground site is a unique situation which offers many opportunities to develop an energy efficient living structure.

The following is a sample plan for converting an underground structure into a living unit. This plan uses the insulation of the earth as its basic way of maintaining a comfortable living climate.

The kitchen is placed on the upper level in order to take advantage of the sunshine during the day. The kitchen is adjacent to an exhaust fan to eliminate cooking odors. The bedrooms are on the second level where the temperature range will be comfortable in summer and winter. On the lowest level is a storage area, which can be used as a workroom. This area is cool year round.

An air vent and exhaust fan work to bring in fresh air which is cooled in summer as it reaches the lower floors. A small heater is used in winter, mainly to heat the upper level which is closest to the earth's cold surface. This heater is placed on the lower level of the house so that the warm air rises to heat the other levels.

It is not important or desirable that the students' design look like this one. They may draw a much more detailed plan. It is important that you guide them so that they are thinking always of using the least amount of energy.

Before You Begin

Each student will need a Design Sheet which gives only the basic structure and temperature information and a Worksheet which gives directions and questions. It would be helpful to review some basic principles:

1. The farther down you go from the earth's surface, the less you feel the surface effects. So, in summer it is cooler underground and in winter it is warmer.
2. Warm air rises.

Words To Know

energy-efficient, insulation

ACTIVITY

1. Read the following introductory statement to students:

"Recently a family living in Colorado decided to make a very serious commitment to saving energy. They realized that their life style demanded great amounts of energy and they were determined to change. The U.S. government at the time was auctioning old missile silos in Colorado. These are underground structures that were once used to store missiles which since have become obsolete. The family bought the missile silo and decided to move in. Your job is to help them design the plans for the inside of their home to help make it as energy-efficient as possible."

2. Give each student a design sheet and worksheet and have them begin.
3. Have students discuss whether the idea of using natural environments for insulation would be effective in New England, which has hills and mountains, (e.g., building a house in the side of a hill).

Resources

"Energy Conservation in the Home," University of Tennessee Environment Center, 1977, p. 37

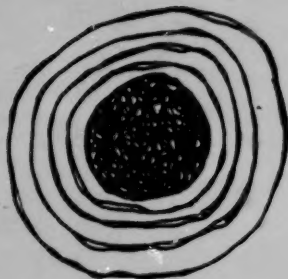
Notes To Myself

STUDENT PAGE

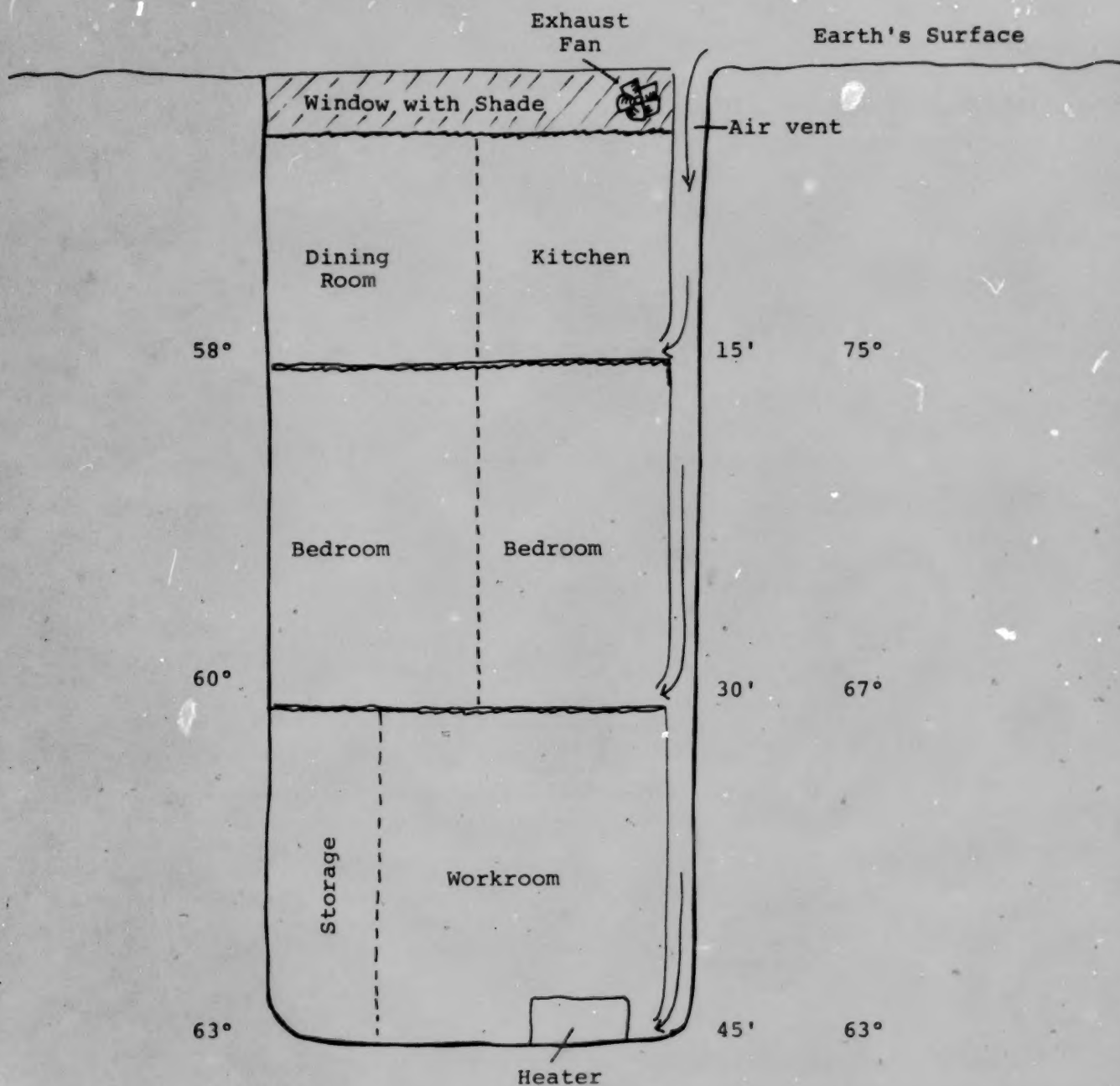
1. EXPLAIN WHY THE TEMPERATURES FROM THE EARTH'S SURFACE DOWN INTO THE GROUND DECREASE IN THE SUMMER AND INCREASE IN THE WINTER. IS THE EARTH A GOOD INSULATOR?
2. YOU HAVE 3 FLOORS TO WORK WITH AND YOU MAY DIVIDE EACH FLOOR INTO MORE THAN ONE ROOM. DECIDE WHERE YOU WILL PUT THE FOLLOWING AND DRAW THEM ON YOUR DESIGN: KITCHEN, 2 BEDROOMS, DINING ROOM, AND ANY OTHER ROOMS YOU FEEL ARE NEEDED.
3. EXPLAIN YOUR REASONS FOR CHOOSING THIS ARRANGEMENT.
4. ONE PROBLEM YOU WILL HAVE TO SOLVE IS THE PROBLEM OF GETTING FRESH AIR INTO YOUR HOUSE. INCLUDE THE SOLUTION OF THIS PROBLEM IN YOUR DESIGN SHEET.
5. ANOTHER PROBLEM YOU WILL HAVE TO SOLVE IS HOW TO HEAT THIS STRUCTURE. DEVISE A PLAN AND ADD IT TO YOUR DESIGN.
6. WILL THIS HOUSE REQUIRE AS MUCH HEATING AS AN ABOVE GROUND HOUSE? WHY OR WHY NOT?
7. ADD ANY OTHER FEATURES TO YOUR HOUSE THAT YOU FEEL IT NEEDS TO MAKE IT COMFORTABLE.
8. HOW DOES THIS STRUCTURE USE LESS ENERGY THAN YOUR OWN HOME?
9. WOULD YOU LIKE TO LIVE IN AN UNDERGROUND HOUSE? WHY?

401

January 4 Temp.
10°F



July 4 Temp.
90°F



Energy Consumption of Appliances

Curriculum Topic

ENERGY - GENERAL

Subject

Science, Home Economics

Environmental Topic

ECONOMICS, TECHNOLOGY - CULTURE

Grade Level(s)

6-8

Site

Classroom

Skills

Obtaining information,
problem solving

Author

Ed Lisk

Objective

The student will be able to:

1. calculate the energy consumption of selected home appliances and equipment.

To The Teacher

All electrical appliances consume electricity in varying amounts. The amount of electricity used is determined by the wattage of the appliance and the length of time the appliance is in use. This consumption is measured in kilowatt-hours. (A kilowatt is 1000 watts used over one hour's time).

If you were to list all the energy-using appliances and equipment in your home, you would see why it is estimated that a well-equipped home consumes as much as 35,000,000 BTU's of energy each year to operate appliances and equipment. Much of this energy is wasted and offers us, as consumers, a great opportunity for conservation of both money and an important energy source.

Before You Begin

Preparation: Make copies of Student Pages.

ACTIVITY

1. Distribute Student Worksheet.
2. Instruct students to complete worksheet using two kitchen appliances and three convenience appliances.
3. Discuss and evaluate information gathered by students on their worksheets.
4. With students explore alternatives to electrical power in the present format.
5. Assign students to write a brief paragraph comparing different brands of one appliance (such as a refrigerator) to determine if some brands are designed to conserve energy.
6. Discussion Questions:
 - a. Do appliances with high wattages use the most KW-hr?
 - b. Does the size of an appliance determine the amount of electricity it uses?
 - c. Do appliances designed to do the same job but made by different companies take the same amount of electricity?
 - d. How essential are the appliances in your home?

Related Activities

1. Extend examples from hourly consumption to weekly, monthly, and yearly consumption.
2. Have students discuss which appliances could be utilized less or eliminated fully.
3. Have students determine, through discussion, which appliances are recreational and which convenience appliances.

Resources

"Tips for Energy Savers", Federal Energy Administration and Energy Research and Development Administration, August 1977.

"Energy and Your Home", York Heating and Air Conditioning, 1978.

Credit

"An Energy Ed./Conservation Curriculum Guide for Home Economics Teachers"; University of Tennessee Environment Center and College of Home Economics, Knoxville, TN, 1977.

Words To Know

BTU, watt, kilowatt, kilowatt-hour

STUDENT PAGE

APPLIANCE ENERGY CONSUMPTION

1. The first step toward conservation is to become familiar with the amount of energy used by each appliance or piece of equipment. This is very easy to do. Find the electrical "ratings" information on the back or bottom of the appliance or piece of equipment. You will see several numbers much like those shown below (these are taken from the base of a food blender).

For service
specify No.
850 - 14A

Model 850
Series U_L
Volts 120
Watts 960
Freq. 25-60 cycle
AC only Jx

The key number is the wattage rating (960 watts in the example above). The wattage is an indicator of the kilowatt-hours of energy used per hour of operation of the appliance. It requires 1 kilowatt-hour per hour of operation for 1000 watts to be used.

In the example above:

Appliance: blender

$$\frac{960 \text{ watts}}{1000 \text{ watts}} = .96 \text{ kilowatt-hr. per hour of operation}$$

Instructions: For two kitchen appliances and three convenience appliances (stereo, hair dryer, etc.), calculate the energy consumed by that appliance in a week.

A. Kitchen Appliance I: _____

$$\frac{\text{_____ watts}}{1000 \text{ watts}} = \text{_____ kilowatt-hr. Kwt-hr. per hr. of operation}$$

$$\text{_____ kilowatt-hr} \times \frac{\text{_____ hr.}}{\text{hours you use in week}} \times 4 \text{ weeks per month} = \text{_____ Kw-hr. per month}$$

B. Kitchen Appliance II: _____

$$\frac{\text{_____ watts}}{1000 \text{ watts}} = \text{_____ kilowatt-hr. Kwt-hr. per hr. of operation}$$

$$\text{_____ kilowatt-hr.} \times \frac{\text{_____ hr.}}{\text{hours you use in week}} \times 4 \text{ weeks per month} = \text{_____ Kw-hr. per month}$$

C. Convenience Appliance I: _____

$$\frac{\text{_____ watts}}{1000} = \frac{\text{_____ watts}}{\text{Kwt.-hr. per hr. of operation}} = \text{_____ kilowatt-hr.}$$

$$\text{_____ kilowatt-hr.} \times \text{_____ hr.} \times 4 \text{ weeks per month} = \text{_____ Kw-hr. per month}$$

D. Convenience Appliance II: _____

$$\frac{\text{_____ watts}}{1000} = \frac{\text{_____ watts}}{\text{Kwt.-hr. per hr. of operation}} = \text{_____ kilowatt-hr.}$$

$$\text{_____ kilowatt-hr.} \times \text{_____ hr} \times 4 \text{ weeks per month} = \text{_____ Kw-hr. per month}$$

E. Convenience Appliance III: _____

$$\frac{\text{_____ watts}}{1000} = \frac{\text{_____ watts}}{\text{Kwt.-hr. per hr. of operation}} = \text{_____ kilowatt-hr.}$$

$$\text{_____ kilowatt-hr.} \times \text{_____ hr} \times 4 \text{ weeks per month} = \text{_____ Kw-hr. per month}$$

2. For each kilowatt-hr. of electricity used it would take 10 ounces of oil-produced energy. For each kilowatt-hr. of electricity it would take 13.3 ounces of coal-produced energy. On the worksheet provided, calculate the amount of oil and coal it would take to run for one month the 5 appliances you chose.

a. Kitchen Appliance I: _____

$$\frac{\text{_____ kw-hr. per month}}{\text{(from Step A)}} \times 10 \text{ ounces of oil} = \text{_____ ounces of oil per month}$$

$$\text{_____ kw-hr per month} \times 13.3 \text{ ounces of coal} = \text{_____ ounces of coal per month}$$

b. Kitchen Appliance II: _____

$$\frac{\text{_____ kw-hr. per month}}{\text{(from Step B)}} \times 10 \text{ ounces of oil} = \text{_____ ounces of oil per month}$$

$$\text{_____ kw-hr per month} \times 13.3 \text{ ounces of coal} = \text{_____ ounces of coal per month}$$

c. Convenience Appliance I: _____

$$\frac{\text{_____ kw-hr. per month}}{\text{(from Step C)}} \times 10 \text{ ounces of oil} = \text{_____ ounces of oil per month}$$

$$\text{_____ kw-hr. per month} \times 13.3 \text{ ounces of coal} = \text{_____ ounces of coal per month}$$

d. Convenience Appliance II: _____

$$\frac{\text{_____ kw-hr. per month}}{\text{(from Step D)}} \times 10 \text{ ounces of oil} = \text{_____ ounces of oil per month}$$

$$\text{_____ kw-hr. per month} \times 13.3 \text{ ounces of coal} = \text{_____ ounces of coal per month}$$

e. Convenience Appliance III: _____

$$\frac{\text{_____ kw-hr. per month}}{\text{(from Step E)}} \times 10 \text{ ounces of oil} = \text{_____ ounces of oil per month}$$

$$\text{_____ kw-hr. per month} \times 13.3 \text{ ounces of coal} = \text{_____ ounces of coal per month}$$

How Was the Village Saved?

Curriculum Topic

ECOLOGY

Subject

Science

Environmental Topic

ECONOMICS, TECHNOLOGY & CULTURE

Grade Level(s)

6 - 7

Site

Classroom, home

Skills

Interpreting data
Mapping data in diagram

Author

Orah Elron

Objective

The student will be able to:

1. interpret data and map this data in arrows as food web on diagram
2. understand that interference in order to solve one problem might have side results that can cause new problems

To The Teacher

All food energy on earth originates from the sun. With the help of the sun, plants are able to produce food by photosynthesis. Plants are eaten by herbivores and these in turn are eaten by carnivores that fall prey to bigger carnivores. The interrelation among all different organisms in a given area is called an ecosystem. In nature, such a system is generally balanced so that all organisms can live and reproduce on the food available. This is called a balanced ecosystem. People's interference in such a system may unbalance an ecosystem, and while solving one problem, cause other new ones unknowingly. It is necessary to understand a whole ecosystem before people dare interfere with it.

Before You Begin

Materials: worksheets, pencils

Words To Know

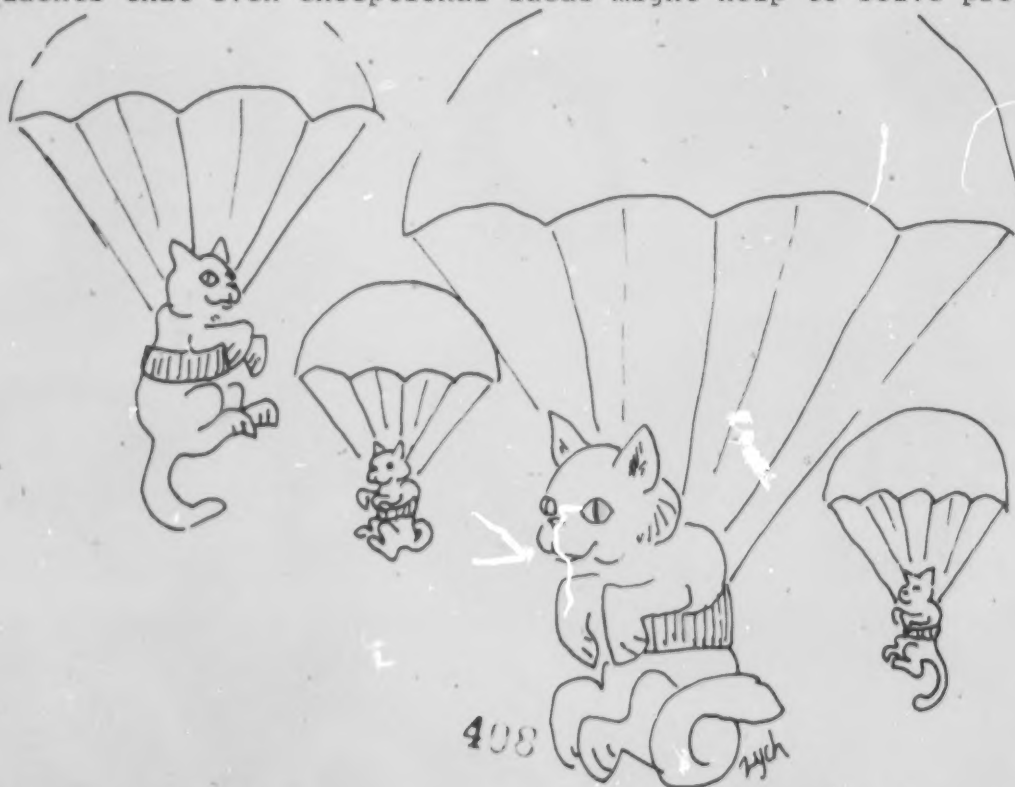
ecosystem, balance, transfer of disease, interdependence, insecticide

In the following story, in the necessary fight against the Anopheles Mosquito (that transfers the Malaria parasite into human blood) other insects became poisoned. The insecticide killed cockroaches, and these in turn, caused cats to die, thus unbalancing the rodent population of the area and consequently spreading another new parasitic disease into Malaysian villages.

The students are asked to draw the diagram of these food chains, adding arrows on the included worksheet. In more advanced classes, draw the food web on a sheet of paper without giving the students previous help. It would be preferable to work in small groups on the problem and afterwards discuss the different solutions with the whole class. Following is a summary of the ecological facts in the story:

1. Man suffered from the malaria disease that was transferred by the Anopheles mosquito breeding in the swamps.
2. Cockroaches lived in the crevices of human quarters. The cockroach population did not grow because the cats living around the huts fed on the cockroach population. The cats fed also on the rodents.
3. To fight the malaria, villagers sprayed the swamps with insecticide to exterminate the mosquitoes.
4. The cockroaches fell sick from the insecticide spray.
5. The cats ate sick cockroaches and as a result, died.
6. The rodent population grew very fast and invaded the villages, bringing with them a new fever disease.
7. Only after introducing a new cat population were the village homes freed of rodents.

The unusual solution of bringing cats to the villages illustrates to students that even exceptional ideas might help to solve problems.



ACTIVITY

1. Introduce the story by telling or reading it to the class. Explain food chain and balanced ecosystem.
2. Have students work on student page. A sample is provided.
3. Divide the class in small groups to finish the worksheet.
4. Discuss the results of the worksheet. Possible questions might include:
 - a) What other solutions to the problem can you suggest?
 - b) Could the problem be avoided?
 - c) Do you know about similar problems and their solutions?

Related Activities

There are many similar stories to be found, and the students would be asked to draw the interdependence among different populations in diagram form.

Resources

Elron, Orah and Amelia Terkel, "The World Around Us," Matal, Tel Aviv University, 1974.

The Day They Parachuted Cats over Borneo, a play by Charlotte Pomeranz and Scott Young, 1971.

New York Times, November 13, 1969.

Credit

Drawing: Cecelia Zych

Notes To Myself

STUDENT PAGE

HOW CAN WE SAVE THE VILLAGE?

This is a true story, about an event that happened not too long ago in several small villages at the edge of the jungle in a far away country - Malaysia. The climate there, close to the equator is hot and very wet. Hot rains fall almost daily. The hills are covered by dense jungle vegetation. There, in the small villages, many people suffered from a horrible disease - malaria. People who have malaria show symptoms of high fever alternating with chills that shake the body uncontrollably every 2 to 3 days. People who suffer from this disease become listless, and many die. Malaria is known in other countries, too. During the Second World War, more people died of malaria than of the war itself! As recently as 1940, malaria was prevalent in the southern United States, too.

Malaria is transferred from person to person by the bite of the Anopheles mosquito. This mosquito feeds on human blood and transfers the malarian parasite from one person's infected blood to another's. One way to fight this disease is to exterminate the Anopheles mosquito that breeds in standing water, swamps and shallow ponds. This can be done by spraying the water's surface with insecticides. In Malaysia, people fought Malaria by spraying the whole swampy area with strong insecticides. As a result, fewer people fell sick with Malaria. The insecticide killed the mosquitoes and other insects, including the huge cockroaches that lived in the warm and wet crevices of human quarters and fed on the abundant garbage in the villages.

Cockroaches are ugly insects that destroy food, rugs and clothes. As you can imagine, Malaysian housewives were very happy to be rid of this pest in their kitchen. But, an unexpected thing occurred. A new kind of fever appeared among the people in the villages as horrible as malaria had been!

Scientists came from England to research the problem and found that the village cats had been feeding on the cockroaches killed by the insecticide. The cats had died of the insecticide, too. With no cats, the mice and other small rodents from the jungle multiplied rapidly and invaded the villages to feed on the garbage. But they brought with them the new trouble (rats are known to transfer terrible diseases to man).

STUDENT PAGE, CONT'D.

The British airforce solved this problem in a strange and unusual way: they imported British cats to the Malaysian villages - parachuting them down to the corner of the jungle!

STUDENT WORKSHEET

DIRECTIONS: FILL IN THE DIAGRAM BELOW WITH ARROWS TO SHOW THE FOOD WEB DESCRIBED IN THE STORY. DRAW ARROWS BETWEEN THE ORGANISM AND ITS FOOD SOURCE. CROSS OUT POPULATIONS THAT DIE. CAN YOU THINK OF ANY WAY PEOPLE COULD HAVE ANTICIPATED AND AVOIDED THIS PROBLEM?

I. SITUATION IN THE BEGINNING:

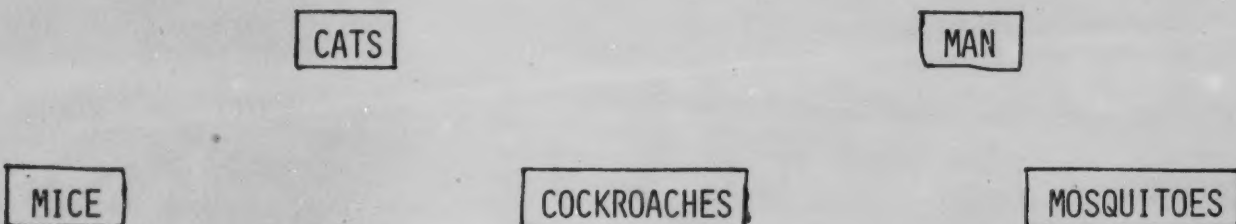


II. SITUATION AFTER SPRAYING WITH INSECTICIDES:



CROSS OUT THE POPULATIONS WHICH DIED.

III. How COULD SCIENTISTS SOLVE THE NEW PROBLEM?



Food Additives

Curriculum Topic

NUTRITION

Subject

Science

Environmental Topic

ECONOMICS, TECHNOLOGY AND CULTURE

Grade Level(s)

7,8

Site

Home and Classroom

Skills

Locating and obtaining information, using information for a purpose

Author

Paul Kubicza

Objective

The student will be able to:

1. examine labels on food packages and identify the food additives.
2. know the function of a food additive.

To The Teacher

Today, the production of chemicals added to food is a big business. Food producers spend more than three hundred million dollars each year on food additives. Unless a family uses only organic foods (foods grown without pesticides, antibiotics, and other chemicals, and processed without manufactured additives) every meal a family eats is almost certain to contain small amounts of a variety of chemicals.

Additives are substances intentionally added to food to enhance its visual appearance, taste, structure, storage life, safety, or nutritional quality.

Not all food additives are artificially manufactured chemicals. Food flavoring and coloring agents are often taken from fruits, spices, herbs, bark and other natural sources. Vegetable gums, gelatines from animal sources, and jelling agents from seaweed are used in many ways to thicken foods and keep them from separating. But the food needs of the world's population have grown too rapidly to be satisfied by natural additives alone. The entire amount of natural vanilla produced in the world each year would not be enough to flavor the vanilla ice cream eaten in the United States. The rest of the vanilla flavoring used in ice cream, puddings, baked goods, and other foods is provided by a synthetic chemical.

Before You Begin

Preparation: Prepare copies of "Major Food Additives and Their Uses". One copy per student would be best.

The "Major Food Additives and Their Uses" sheets have only the top 81 food additives. Supplement this with the excellent source book, Eater's Digest: The consumer's Factbook of Food Additives.

Students need paper and pencils.

Words To Know

food additive, preservative, stabilizer, tartness, acidity, emulsifier, leavening agent

Definitions:

Food additive - a substance added to food to enhance its visual appearance, taste, structure, storage life, safety, or nutritional quality.

Emulsifier - a substance to aid the mixing of water-like and oil-like substances that ordinarily do not mix well.

Leavening agent - a substance that aids in the food production process.

Preservative - a chemical that increases the shelf life of a food. It is used to prevent bacterial growth, oxidation, or staling.

Stabilizer - a substance used to improve the texture of or thicken a product.

Tartness - the taste sensation of tasting tart.

Related Activities

1. Students can research more information on any food additives.
2. Compare the number of foods vs. food additives on the labels.
3. Stage a contest to find the food products with most additives and those with fewest.
4. Investigate the role of the Food and Drug Administration.

Resources

Let's Talk About Food, ed. White, P. and N. Selvey, Publishing Sciences Group Inc., 1974, p. 249-266.

Jacobsen, Michael F., Eater's Digest: The Consumer's Factbook of Food Additives, Anchor Books, 1972.

Silverstein, Dr. Alvin and Virginia Silverstein, The Chemicals We Eat and Drink, Follet Publishing Company, 1973, pp. 33-58.

Whelan, Dr. Elizabeth M. and Dr. Fredrick J. Stare, Panic in the Pantry, Atheneum, 1976, p. 106-136.

ACTIVITY

1. Give students the following homework assignment:

- a. Pick out any 10 food packages at home from the freezer, refrigerator, or canned goods and groceries.
- b. Have students record the following information from the food package label:
 - 1) name of food
 - 2) manufacturer
 - 3) ingredients

Be sure to list all of the ingredients.

2. When students return their homework assignment, do the following in class:

- a. Pass out copies of "Major Food Additives and Their Uses"
- b. Discuss the meaning of food additive, preservative, stabilizer, emulsifier, acidity, tartness, and leavening agent. A list of definitions is given.

3. Students are to classify all of the ingredients on their labels as either food or food additive. For each food additive they must record its use. A workable format follows:

<u>Substance</u>	<u>Food or Food Additive</u>	<u>Use of Food Additive</u>
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The following example comes from a can of lemonade mix:

<u>Substance</u>	<u>Food or Food Additive</u>	<u>Use of Food Additive</u>
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Sugar	x	
Lemon juice	x	
Citric acid	x	provides tartness,
Sodium benzoate	x	preservative

4. Discussion Questions:

- a. What are food additives used for?
- b. Are food additives necessary?
- c. What would happen if (your choice) food additives were removed from a product?
- d. Are food additives good or bad?
- e. Does anyone test food additives to be sure they are safe?
- f. What is saccharin?
- g. Is saccharin dangerous? What is your opinion based on?
- h. Should food additives be banned?
- i. How many food additives are there?
- j. If saccharin products are proven unsafe, should they still be made available to diabetics who can't use sugar?

STUDENT PAGE

Major Food Additives and Their Uses

Adipic Acid - for tartness
Alginate - a thickener made from seaweed
Alum - stabilizer
Ascorbic Acid - Vitamin C, a preservative
Benzoate of Soda - a preservative
Beta Carotene - Vitamin A
BHA - a preservative
BHT - a preservative
Calcium Caseinate - improves texture
Calcium Disodium EDTA - a preservative
Calcium Propionate - a preservative
Carob Seed Gum - thickener and stabilizer
Casein - improves texture
Caramel - coloring
Cellulose - adds body
Cellulose Gum - adds body
Citric Acid - provides tartness, improves stability
Corn Syrup - thickener, sweetener
Dextrose - sweetener
Dextrin - thickener
Diglycerides - prevents staling, improves stability
Disodium Guanylate - flavor enhancer
Disodium Inosinate - flavor enhancer
Disodium Phosphate - controls acidity
EDTA - preservative
Fumaric Acid - provides tartness
Fruit Pectin - thickener
Gelatin - thickener
Guar Gum - stabilizer
Gum Arabic - thickener
Lecithin - preservative, emulsifier
Monoglycerides - prevents staling, improves stability
Monosodium Glutamate - flavor enhancer
MSG - flavor enhancer
Niacin - a vitamin
Niacinamide - a vitamin

Oxystearin - prevents clouding of vegetable oils
Pectin - thickener, emulsifier
Polysorbate 60, 65, and 80 - emulsifiers
Potassium Bromate - flour treatment agent
Propyl Gallate - improves stability
Propylene Glycol - maintains moisture content
Pyridoxine - Vitamin B₆
Riboflavin - Vitamin B₂
Saccharin - sweetener
Salt - preservative, flavor
Sodium Acid Pyrophosphate - a preservative
Sodium Alginate - thickener
Sodium Aluminum Phosphate - leavening agent
Sodium Ascorbate - Vitamin C
Sodium Benzoate - a preservative
Sodium Bicarbonate - a preservative
Sodium Bisulfite - a preservative
Sodium Citrate - flavoring
Sodium Nitrate - preservative, provides color
Sodium Nitrite - preservative, provides color
Sodium Phosphate - a preservative
Sodium Saccharin - sweetener
Sodium Sulfate - a preservative
Sorbic Acid - a preservative
Soy Protein - protein source
Sulfur Dioxide - a preservative
Thiamine - a vitamin (B₁)
Tragacanth Gum - thickener
Triphosphosphate - preserves moisture
Tricalcium Phosphate - anti-caking agent
Vanilla - flavoring
Vanillin - flavoring
Vegetable Gum - thickener
Vegetable lecithin - emulsifier
Xanthan Gum - thickener

Synthetic Rubber

Curriculum Topic

CHEMISTRY

Subject

Science

Environmental Topic

ECONOMICS, TECHNOLOGY & CULTURE

Grade Level(s)

8

Site

Classroom

Skills

Observing, analyzing information

Author

Paul Kubicza

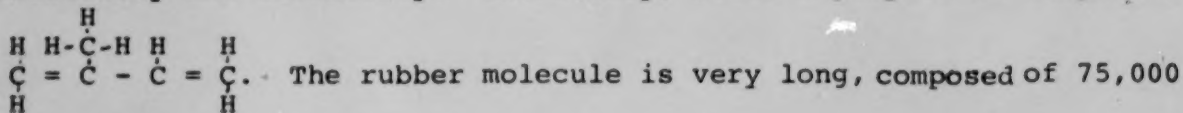
Objective

The student will be able to:

1. give evidence for the need for synthetic rubber
2. describe how synthetic rubber is made.

To The Teacher

Rubber is an organic substance which has the desirable properties of elasticity and durability. Chemically, it is a polymer of isoprene:



carbon atoms and 120,000 hydrogen atoms.

Rubber is a natural product which we have learned to produce by a synthetic process. In its natural state, it is formed in a living tree and consists of the solids separated from the milky fluid latex, found under the bark of many tropical trees and shrubs. Today more than half the rubber on the market is manufactured synthetically.

World consumption of rubber has increased from 53,000 tons in 1901 to 1,118,000 tons in 1939 to 8,485,000 tons in 1972. Yet natural rubber production has increased from only 53,000 tons in 1901 to 3,120,000 tons in 1972. Natural rubber grows within the narrow area that extends 700 miles north and south of the equator. This area cannot supply the tremendous demand for rubber that has arisen from the mass production of tires and other rubber products since the 1930's. Synthetic rubber has become necessary to meet this demand, relieving the burden on rubber producing areas in Malaya, Indonesia, Africa, and South America.

In 1826 Michael Faraday assigned the empirical formula C_5H_8 to rubber. In 1860 Grenville Williams reduced rubber to a liquid and named it isoprene. In 1890 Sir William Tilden observed that a rubber-like substance had formed in a bottle of isoprene left standing for several years. In the 1930's, scientists mixed butadiene and styrene to produce the first synthetic rubber. World War II cut off supplies of natural rubber. Mass production of synthetic rubber began. This mass-production continues.

This activity will enable you to produce a synthetic rubber from ethylene dichloride (CH_2ClCH_2Cl). It is an extremely flammable substance whose vapors can be harmful if inhaled. The activity should be done only as a teacher demonstration in a well-equipped laboratory. If the materials or resources are not available, see Related Activities for a substitute method.

Before You Begin

Preparation: Prepare classroom copies of "World Rubber Consumption and Production", included at the end of this activity.

Materials:	ethylene dichloride (CH_2ClCH_2Cl)	balance
	magnesium hydroxide ($Mg(OH)_2$)	burner
	sodium hydroxide (NaOH)	matches
	sulfur (S)	ring
	beaker, 250 ml	ring stand
	graduated cylinder, 100 ml	spatula
	stirring rod	thermometer cork
	thermometer	test tube clamp
	asbestos pad	weighing paper
	safety goggles	

Caution: Ethylene dichloride is extremely flammable and the fumes can be harmful. Magnesium hydroxide and sodium hydroxide are caustic.

Words To Know

rubber, synthetic, polymer

ACTIVITY

1. Pass out copies of "World Consumption and Production." Discuss with class. The following questions may be of value:

- a. What is rubber used for?
- b. In what amount did the world rubber consumption increase from 1901 to 1939?
- c. Did the production of natural rubber keep pace with consumption from 1901 to 1939?
- d. How did the world rubber consumption increase from 1951 to 1972?
- e. Did the production of natural rubber keep pace with consumption from 1951 to 1972?
- f. Where did the extra rubber come from during the 1951 to 1972 period?
- g. Do you think rubber consumption is still increasing today? Why or why not?

2. Explain how the supplies of natural rubber were inadequate and how synthetic rubber was eventually produced.

3. Demonstrate to the class how synthetic rubber is made:

- a. Dissolve 10 gm NaOH in 150 ml water in a 250 ml beaker.
- b. Heat the solution until it boils.
- c. Slowly add, while stirring, 20 gm of sulfur.
- d. Continue to boil and stir for 10 minutes.
- e. Allow solution to cool.
- f. Add 3 gm of $Mg(OH)_2$ to the liquid and reheat to $70^{\circ}C$.
- g. Slowly add, while stirring constantly, 30 ml of ethylene dichloride to the beaker.
- h. Keep the temperature between 70° and $80^{\circ} C$.
- i. Continue heating and stirring for 15 minutes.
- j. Turn off the burner and allow beaker to cool.
- k. Pour off liquid.
- l. Rinse rubber in the beaker with 50 ml portions of water until water is almost colorless. Squeeze rubber with a spatula while rinsing.

4. After rinsing the rubber, you can test to see how it stretches and bounces. Wash your hands immediately and do not allow students to touch it as there may be caustic hydroxide on it.

Related Activities

1. Obtain some natural latex from a rubber or foam rubber company. slowly add 50 ml latex to 200 cl of a weak acid (vinegar is fine) while stirring constantly. The rubber will coagulate around the the stirring rod. Rinse well.

NOTE: Avoid getting natural latex on your clothes. It is very difficult to remove.

2. Have a contest to see which student can think of the most uses for rubber.

Resources

"Natural Rubber - How Nature and Science Serve Mankind", Natural Rubber Bureau, Washington, DC 1973.

"Rubber", Firestone Tire and Rubber Company, 1960.

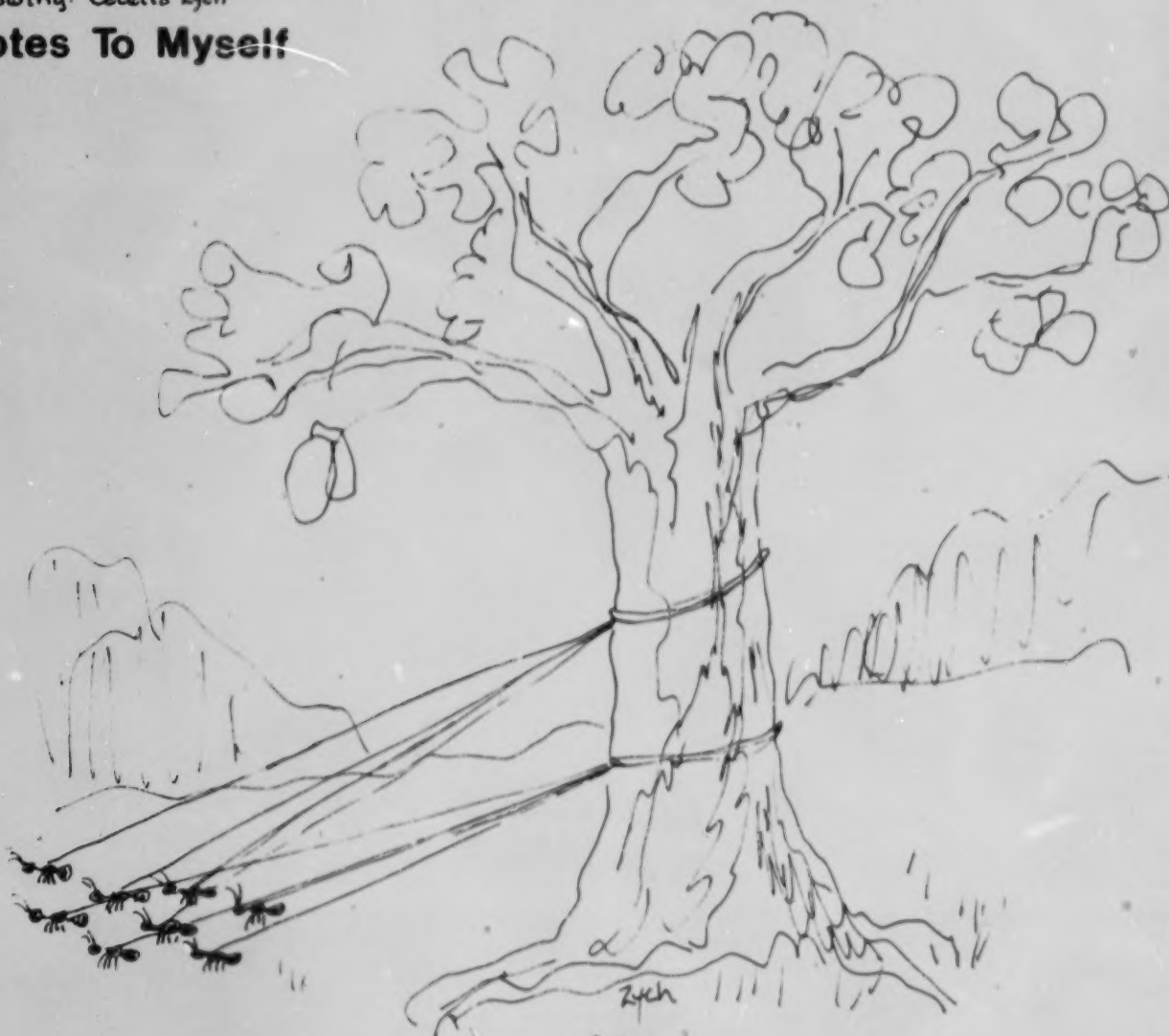
"Story of Natural Rubber", Malaysian Rubber Bureau, Washington, DC 1973.

Credit

Messer, M., et al, Prentice-Hall, Inc., Introductory Experimental Chemistry, Prentice-Hall, Inc., 1977, pp 378-379.

Drawing: Cecelia Zych

Notes To Myself



"Once there was a little
ol' ant..."

420

STUDENT PAGE

World Rubber Consumption and Production

<u>Year</u>	<u>World Rubber Consumption (tons)</u>	<u>Natural Rubber Production (tons)</u>
1901	53,000	53,000
1911	102,000	102,000
1921	285,000	285,000
1931	694,000	694,000
1939	1,118,000	1,118,000
1951	2,500,000	1,540,000
1964	5,008,000	2,260,000
1972	8,485,000	3,120,000

Why are Atoms in and Demons Out?

Curriculum Topic

SCIENTIFIC METHOD and PHILOSOPHY

Subject

Science
Social Science

Environmental Topic

ECONOMICS and TECHNOLOGY
CULTURE

Grade Level(s)

7 - 8

Site

Classroom

Skills

Listening with comprehension
Recognizing and defining problems
Classifying
Concluding

Author

Orah Elron

Objective

Given a specific hypothesis students will be able to: analyze information and reach scientific conclusions.

To The Teacher

Students are accustomed to listening to scientific information and taking notes from a lecture or book without evaluating the information. They receive all academic information as true.

The following activity motivates students to stop and think, and, as a result, learn to use their own judgment in evaluating presented information. In this activity the experiment will be explained scientifically and, also, according to witchcraft. Science is based on the explanation of experiments:

"...the majority of scientific achievements are accomplished by well-planned experiments.

"If, while observing an experiment, a scientist has an idea concerning the general behavior of matter in the experiment, he may propose a hypothesis. This hypothesis is a tentative supposition to explain certain facts. To test the hypothesis, the scientist must conduct more experiments to obtain more supporting information, and then evaluate the results. If the results support his hypothesis, he may advance a theory concerning the investigation. This theory is a verified hypothesis, a general principle that may be used to explain certain phenomena. Theories generally involve some speculation and are subject to change when more reliable facts are discovered. The atomic theory, for example, is still being refined today. If a hypothesis or a theory has withstood the test of further experiments, it may become a scientific law.

A scientific law is a precise statement of fact explaining the regularity of natural phenomena.

The reasoning or inductive method of solving a problem is known as the scientific method. The scientific method is a logical, organized way of answering any question that can be answered by experimental investigation. It consists of (1) collecting facts through observation and experimentation; (2) carefully analyzing and evaluating these facts and proposing hypotheses (or theories) to explain the data collected; and (3) planning further experiments to test those hypotheses and establish their use for further experiments. (from Chemistry, M. Hein, Mt. San Antonio College, 1973, p. 4)

Sorcery and witchcraft have tried to explain phenomena around us throughout human history. They have suffered often and died under the false blame of having caused a natural phenomenon, such as an epidemic or an earthquake.

Before You Begin

Prepare two students in advance. Provide them with Role Profiles and refer them to the library. Their task is to role play the Atom Man and the Demon Man in the explanation of a simple experiment (e.g., the burning of a candle in a tightly covered jar). It might be advisable to have two students work on each role, so that together they can prepare their argument more thoroughly.

Words To Know

atom, demon, hypothesis, theory, scientific law, scientific method, experiment, oxygen, carbondioxide, sorcery, witchcraft



"Eure-e—

423



Sorry, false alarm!"

ACTIVITY

The role-playing students will present an experiment to the class such as "the candle burning in a tightly covered glass jar." When the flame dies down, the atom-men will explain their detailed scientific opinion: "All the oxygen in the jar was used by the flame, creating CO_2 that does not allow for any further burning..." Demon: "How can something you can't see or smell put out a flame?" The demon-men may interrupt at any time, giving their "better" explanation: "Inside every glass jar lives a tiny demon that hates the flame and fights it, so that the flame slowly becomes smaller till the demon finally succeeds in extinguishing it. Of course, should the jar be open, the demon would rather escape the hated flame than fight it..."

If the students are well prepared, they will have an answer to any argument brought up by the "scientist" or the audience. Replace the candle by another less obvious chemical experiment in order to strengthen interest and motivation for the class (e.g., chemical changes of color in a fluid, etc. or disease). Show only one experiment - leave everything else to the role play.

Related Activities

Reading about the history of science, students may prepare for the role of a well-known scientist of the past (Galilei, Boyle, Dalton, Rutherford, etc.). Two of these famous scientists will then "meet" in class by role-play and discuss their particular scientific interests and opinions with each other.

Resources

Hein, M., Chemistry, Mt. San Antonio College, 1973, p. 4

Holden, Glen, The Nature of Atoms, Oxford University Press, 1971

Credit

Koestler, Arthur, "The Sleepwalker", Science Teacher Education Project, MacGraw Hill (UK), 1974

Notes To Myself

STUDENT PAGE

ROLE PROFILE: SCIENTIST

You are a modern scientist. Science helps you to understand chemistry, physics and medicine. Therefore, chemical processes such as those in the burning of a candle are familiar to you. The candle burns in a closed glass container that is, of course, full of air. This air contains $1/5$ free oxygen, necessary to the process of burning. When you light the candle, the carbon of the wick combines with the oxygen of the air through the process of burning and produced CO_2 until all the O_2 is used up. Without O_2 , burning is no longer possible and the flame dies.

To help you play the role of scientist you can find scientific explanation for experiments in elementary chemistry books. Chemistry explains the way atoms of different elements combine to form molecules of new compounds. With the background of your scientific training you do not need supernatural explanations of ghosts and demons.

ROLE PROFILE: SORCERER

You believe in demons and witchcraft as the only explanation for all processes around us. Everywhere live invisible demons of all sizes which take care of all that goes on. When we light a flame, the little demon that lives in the jar gets very uncomfortable. He hates the light and the heat, and will fight it with all his limited strength until he succeeds in extinguishing the flame and restoring his home to its original state. Of course, if we leave the jar open, he would rather escape than struggle with the flame that is as big as himself.

Little demons live in our bodies, too. They are quiet if we leave them alone, but can become very unpleasant if we annoy them by staying out too long in the rain, for example. They become so upset that they turn against you from inside your body, thus causing pain and sickness. How else can anyone explain that rain and cold feet cause pain in the throat? Some demons are very powerful. For instance, those that live in magnets will hold on to any other iron that comes close with unexpected strength.

STUDENT PAGE. CONT'D.

We can train our demons to help us. Those that live in the wires of lamps, for example, turn the lights on for us, but when they get angry they are dangerous and kill people who touch their wires.

All this scientific nonsense about atoms makes no sense to you. Even scientists confess that nobody has ever seen an atom, so how can invisible atoms form matter that we see and touch? Ever since the beginnings of history, people knew about demons. Surely they exist!

STUDENT INFORMATION SHEET

The Tennessee Valley Authority (TVA) is an independent government agency financed by Congress to control the waterways of the Tennessee River Basin, an area of 41,000 square miles. The TVA builds dams to help navigators, to control floods and to generate hydroelectric power. It also assists in soil and forest conservation and in creating recreational areas.

One of many new projects for the area is the Tellico Dam, a \$119 million project designed to create a large lake with a shoreline industrial park. The project would bring jobs to large numbers of the unemployed. Near completion, this project has been halted. It has been learned that in the thirty-eight miles of clear free-flowing water below the dam, there exists a three-inch fish called a snail-darter, first discovered in August, 1973. Environmentalists argue that this species exists only in this river. If the dam is completed, the snail-darter will become extinct.

The Supreme Court of the U.S. must decide to let the fish live or to make an historical change in the current Endangered Species Act by allowing the Tellico Dam Project to continue, thereby eliminating a species of life. What would you decide?

Alaska Priorities

Curriculum Topic

ENERGY-ELECTRICITY

Subject

Science

Environmental Topic

ECONOMICS, TECHNOLOGY - CULTURE

Grade Level(s)

6-8

Site

Classroom

Skills

Identifying feelings about alternatives, choosing freely, citizenship skills

Author

Ed Lisk

Objective

The student will be able to:

1. evaluate the need for or use of several common electrical appliances.

To The Teacher

One hundred years ago electricity was a novelty, and for today's world is an essential. Staggering amounts of electricity are utilized, and approximately every 10 years, the world's demand for electrical energy doubles. A modern city cannot exist without electricity and petroleum. All aspects of living should not require electricity, but most do.

To date, only two proven advanced methods for commercial production of electricity exist to replace the use of petroleum reserves soon exhausted. One is the burning of fossil fuels, namely coal. Although coal is abundant, there are air pollution problems from burning it and health and environmental hazards from mining it. The other method uses uranium - 235 in a light-water nuclear reactor. Inexpensive nuclear fuel is limited. As more costly ores are exploited, electricity costs escalate and as with strip mining of coal, the same rape of the landscape results.

Large-scale alternatives for production of electricity include: the nuclear breeder reactor, nuclear fusion reactor, geothermal energy, solar energy, and coal gasification and liquifaction. The problems involved with all these alternatives are immense.

Before You Begin

Materials: student worksheets, pencils

Words To Know

electricity, consumption, high quality life, energy-efficient



ACTIVITY

1. Discuss the use of energy in students' everyday lives. Try to establish people's dependence on electrical appliances.
2. Distribute a copy of the story/worksheet to each student.
3. After the students have finished the worksheet, have them consider the following questions:
 - a. Determine which appliances use the most energy and which ones are more energy-efficient.
 - b. Could some appliances be eliminated from our lives? Indicate which ones and why?
 - c. Consider why we use appliances that can be easily or very easily done without.
 - d. Rate all the appliances on the worksheet from 1 to 33 with 1 being the most necessary and 33 being the least necessary.

Related Activities

1. Determine the approximate cost of electricity for different home appliances.
2. Explore the history and time of introduction of the various electrical appliances.

Resources

"Oklahoma Energy Awareness Education" (4-12), Oklahoma State Department of Education, 1977, EEC # 1355.

Credit

Clegg, Peter, New Low Cost Sources of Energy for the Home, Garden Way Publishing, 1975.

Morrison, James W., ed., The Complete Energy-Saving Home Improvement Guide; Arco Publishing Co., 1976.

Drawing: Cecelia Zych

Notes To Myself

STUDENT PAGE

Jim and Pat Kelly are building a cabin in wilderness area in Alaska. They will have no electricity (even though it is available in a nearby town where Mr. Kelly works, but that's the way they want it. They have some strong convictions about living simply. But, there are few people like the Kellys. Many people cannot imagine life without electricity. They consider it absolutely essential to a continued high quality of life. How do you feel about the use of electricity? Place a check in the column which best describes your attitude toward doing without each of the following electrical items:

	Very Easily	Easily	With Some Difficulty	With Great Difficulty	Impossible
Radio					
Stereo					
Air conditioning at home					
Air conditioning at work/school					
Dishwasher					
Clothes washer					
Iron					
Electric stove					
Refrigerator					
Lights					
Central heating					
Doorbell					
Ice crusher					
Toaster					
Hair dryer					
Television					
Electric fans					
Clocks					
Vacuum cleaner					
Microwave oven					
Freezer					
Blender					
Electric blanket					
Electric typewriter					
Thermostatic controlled furnace					
Electric can opener					
Telephone					
Electric toothbrush					
Electric frying pan					
Water heater					
Garbage disposal					
Trash compactor					
Power tools					

World's Largest Monument to the World's Smallest Fish

Curriculum Topic

MAN'S ECOLOGICAL ROLE
ECOLOGY

Subject

Science, Social Studies

Environmental Topic

ECONOMICS, TECHNOLOGY and CULTURE;
ECOSYSTEMS

Grade Level(s)

Adaptable

Site

Classroom

Skills

Problem solving

Author

Cyndi Walsh

Objective

At the conclusion of this activity, the student will be able to propose and defend reasons for a decision.

To The Teacher

The purpose of this activity is to involve the students in a contemporary Supreme Court decision which concerns a vital environmental issue. For the first time in history in 1978, the Supreme Court of the United States had to make a conscious decision to let live or liquidate a species of life. In a 6 to 3 decision, the Court ruled in favor of the Endangered Species Act by halting a \$119 million project already near completion. The snail-darter, a three-inch fish found nowhere on earth but at the project site will be allowed to live. As the Governor of Tennessee said, "We have the world's largest monument to the world's smallest fish." (See To the Teacher for background.)

Before You Begin

Materials: paper and pencil, duplication of the information sheet for the members of the class

Words To Know

extinct, endangered, transplanting, floodgating, TVA

ACTIVITY

1. Introductory question: Ask the class to name a fish they could catch in a river. Can they name an endangered species? Ask if they have heard of the snail-darter fish?
2. Pass out information sheet and read aloud.
3. After reading the information sheet, ask the class to consider solutions to the snail-darter dilemma.
4. Conduct a brainstorming session. Later, list the suggested alternatives on the board. (See Teacher Notes for complete list.)
5. Divide the class into three groups to represent
 - a) the Tennessee Valley Authority
 - b) environmentalists
 - c) unemployed residents of the county.
6. Ask each group to rank the alternative solutions that best meet their needs, according to the roles they are playing.
7. Ask one representative from each group to join a summit group in which the needs and decisions of each interest group will be shared.
8. Explain transplanting and floodgating alternatives and discuss why they have failed. (See Teacher Note.)
9. Ask class to make personal decisions (private ballot) to stop or continue the project.
10. Tell the class of the Supreme Court ruling and discuss its implications for the future.

Hints to the Teacher:

1. Transplanting was unsuccessful: only adult fish were found, indicating that spawning had been unsuccessful.
2. Floodgating did not allow adult fish to return upstream to spawn - a necessary part of their lifecycle.
3. Alternatives considered by TVA, environmentalists and Congress:
 - a) leave the dam standing as a monument to our environmental responsibilities,
 - b) transplant the fish
 - c) amend laws
 - d) put bounty on snail-darter fish found in other places
 - e) use floodgates

Related Activities

Research other successful attempts to preserve wildlife habitats: investigate the habitats of the snowy egret, osprey, baleen whale, trumpeter swan, whooping crane.

STUDENT PAGE

STUDENT INFORMATION SHEET

THE TENNESSEE VALLEY AUTHORITY (TVA) IS AN INDEPENDENT GOVERNMENT AGENCY FINANCED BY CONGRESS TO CONTROL THE WATERWAYS OF THE TENNESSEE RIVER BASIN, AN AREA OF 41, 000 SQUARE MILES. THE TVA BUILDS DAMS TO HELP NAVIGATORS, TO CONTROL FLOODS AND TO GENERATE HYDROELECTRIC POWER. IT ALSO ASSISTS IN SOIL AND FOREST CONSERVATION AND IN CREATING RECREATIONAL AREAS.

ONE OF MANY NEW PROJECTS FOR THE AREA IS THE TELlico DAM, A \$119 MILLION DOLLAR PROJECT DESIGNED TO CREATE A LARGE LAKE WITH A SHORELINE INDUSTRIAL PARK. THE PROJECT WOULD BRING JOBS TO LARGE NUMBERS OF THE UNEMPLOYED. NEAR COMPLETION, THIS PROJECT HAS BEEN HALTED. IT HAS BEEN LEARNED THAT IN THE THIRTY-EIGHT MILES OF CLEAR FREE-FLOWING WATER BELOW THE DAM THERE EXISTS A THREE-INCH FISH CALLED A SNAIL-DARTER, FIRST DISCOVERED IN AUGUST, 1973. ENVIRONMENTALISTS ARGUE THAT THIS SPECIES EXISTS ONLY IN THIS RIVER. IF THE DAM IS COMPLETED, THE SNAIL-DARTER WILL BECOME EXTINCT.

THE SUPREME COURT OF THE U.S. MUST DECIDE TO LET THE FISH LIVE OR TO MAKE AN HISTORICAL CHANGE IN THE CURRENT ENDANGERED SPECIES ACT BY ALLOWING THE TELlico DAM PROJECT TO CONTINUE THEREBY ELIMINATING A SPECIES OF LIFE. WHAT WOULD YOU DECIDE?

Here Come the Clones

Curriculum Topic

HUMAN ANATOMY - REPRODUCTIVE
SYSTEM

Subject

Science

Environmental Topic

ECONOMICS, TECHNOLOGY AND
CULTURE, ENVIRONMENTAL ETHICS

Grade Level(s)

6-8

Site

Skills

Analyzing, listening, speaking,
evaluating information, recognizing
problems, identifying values

Classroom

Author

Thomas J. Kotulski

Objective

After completing this activity, students will be able to discuss critically the efficiency of continued efforts at genetic control.

To The Teacher

Recent developments in genetics have opened up a number of new possibilities: extrauterus fertilization ("test tube babies"), genetic counseling and screening of "defects," artificial recombination of genetic traits, cloning, etc.

Some of these developments may benefit many people. But they may be made accessible only to a few. Or, if abused, they may be detrimental to society.

Each animal and plant species has a characteristic number of chromosomes arranged in homologous pairs. These chromosomes, composed of DNA and protein, carry the hereditary material in continuous assemblies of molecules called genes. In sexually reproducing organisms, the embryo forms as a result of the union of the male and female sex cells. These cells, after a complex process known as reduction division or meiosis, in which there is much recombination of the genetic material, contain only one-half the necessary complement of chromosomes. When the sex cells unite in fertilization, the necessary pairs are re-formed. The process of genetic change in meiosis and recombination of sex cells (in most organisms, from two parents) gives sexual reproduction its primary evolutionary advantage for almost endless genetic diversity. This diversity provides the raw material on which natural selection works.

A clone, by contrast, is a genetic replica of its "parent." Clonal organisms are unusual in higher animals, but they are not uncommon in nature. Amoebae yeast cells, bacteria and other microorganisms that reproduce by fission are examples. Many plants also reproduce asexually. Entire fields of ferns may be composed of genetically identical but physiologically distinct individuals.

Today, scientists are exploring the possibility of cloning higher animals, including man. The potential to eliminate diversity and replicate human beings poses serious ethical questions.

"The conditioners of Brave New World cloned large numbers of identical individuals to perform specialized functions. This was one of their 'Major instruments for maintaining social stability'. To many people, cloning is perhaps the most frightening prospect of genetic engineering, since its misapplications in a totalitarian society are easily imagined. At the same time, most people (including many scientists) relegate talk of cloning people to mere science fiction fantasy, or disregard the matter completely as being irrelevant...And yet achieving human cloning is likely to be one of the most simple forms of genetic technology.

"Cloning has already been carried out with at least one species of animal, the frog. The technique is straight-forward. Unfertilized frog eggs are collected and by delicate surgery the nucleus is removed and replaced by the nucleus obtained from a body cell of an adult frog. Introduction of the body cell nucleus apparently stimulates the egg as if it had been fertilized by a sperm, and the egg with the transplanted nucleus matures into a frog identical to the donor frog. Since the donor frog is composed of millions of cells, it is possible, at least in theory, that any particular frog could be the 'parent' of literally millions of cloned replicas of itself - and each of these replicas could, in turn, serve as parents for millions of additional replicas, etc.

"Why clone a frog? In the field of animal development, the cloning experiment was central in the proof that each body cell retains all of the genetic information originally found in the sex cells. But once this fact has been established in frogs, why is it necessary to repeat the experiment in mammals, which is considerably more difficult? In particular, why is the specialized technology required for human cloning being developed?

"There are basically two reasons why the techniques for human cloning are being studied - to increase the knowledge of how fetuses grow and for use in medicine to treat infertility and genetic diseases. There is certainly a lot that could be learned by studying human fetal growth outside the mother. But most embryologists, like other scientists, prefer not to think about the impact their research might have on society, about how it will probably be used. They prefer to concentrate on their science, including 'test-tube babies,' and leave the moral and political decisions to someone else. According to Joshua Lederberg, the '...scientific community should impose criteria of scientific validity for funding or dissociate itself from responsibility when it does not have the authority to make the critical decisions...'. "

" Methods have recently been perfected to remove the nucleus from mammalian cells and the same method will probably work on egg cells as well. Therefore, probably work on egg cells as well. Therefore, probably the major difficulty which remains before human cloning is feasible, is the introduction of a body cell nucleus." ("Genetic Engineering")

This activity envisions a world which has gone one step beyond simple cloning. In this imaginary world, genetic engineers have perfected techniques with recombinant DNA. They can make human beings to order. While cloning is itself still a thing of the future, the world imagined here is much further away. However, it is never too early to thoughtfully consider the implications of advancing technology.

Before You Begin

MATERIALS: clone order form (copies for each student)

Words To Know

fertilization, diploid, haploid, DNA, chromosome, nucleus, gene, heredity, genetics, clone, geno cerebral, geno physical, passive, dominant, introvert, hyperkinetic, submissive, extrovert, hypokinetic, gestation, in-vitro, epidermal cell, extra-utero

ACTIVITY

1. Introduce the topic in normal sequencing of topical studies or
2. Hand out the form unannounced. (This technique is effective because of the element of surprise.)
3. After the clone forms are passed out, tell the students to read only the instructions without talking or asking any questions. Allow them 10 minutes to complete the form.
4. After sufficient time has passed, stop the students.
5. On the blackboard or on a separate clone order form, have several students record the choices of all the class for determining what the class feels are desirable traits in offspring. Tally the number of responses from the class for each characteristic. Discuss trends evident from the tally.
6. Discuss the following questions:
 - a) What generalization can we make about the type of offspring people want?
 - b) Why do people value certain physical, psychological qualities?
 - c) How will people feel about themselves if they do not have these valued qualities?
 - d) What do our class choices say about our society and what it values in a person's qualities? What quality does society not value?
 - e) Would every classes' choices be the same? What would make their choices different or alike?
 - f) If cloning were possible, should it be allowed? Brainstorm reasons why or why not and record answers on the blackboard.
 - g) After brainstorming, discuss who should decide to clone or not to clone. (For example, the people of Cambridge, Mass. have forbidden Harvard to conduct these experiments except under strict control.)
7. Hold a class vote on whether or not cloning should be allowed.

Related Activities

Have students write a paragraph on what is normal, what is anti-social and who defines these conditions?

Resources

"Genetic Engineering," Science and Society Series, Jamaica Plains, Boston, No. 3

Credit

Grossman, Edward, "The Obsolescent Mother. A Scenario," The Atlantic Monthly, May, 1971, p. 39

Kass, I., "Babies by Means of in vitro Fertilization: Unethical Experiments on the Unborn?" New England Journal of Medicine, 285: 1174, 1971

Powledge, T., "The New Ghetto Hustle," Saturday Review of Science, February, 1973, p. 38

Zimmerman, et al, "Towards a Science for the People"

STUDENT PAGE

CLONE ORDER FORM

Pacific Institute of Technology

TO PROSPECTIVE PARENTS:

April 22, 2001

Congratulations on your decision to become a parent. We are sending this order form for your clone in response to your inquiry.

We are indeed fortunate to live in the twenty-first century for, through science, we are no longer at the mercy of mother nature when it comes to acquiring children. There was a time - many of you may remember - when to produce an offspring we were limited to sexual reproduction.

In ordering your child (clone) fill in the spaces below with careful consideration. Submit this form to the biogenetics culture laboratories of Pacific Institute of Technology's medical school along with (a) The U.S. Department of Genetic and Cloning Control Certificate of Permission for Parenthood, and (b) a sample of skin cells of each prospective parent. (If there is to be one parent only one sample of cells are necessary. Of course if there are to be two, three or more parents of the clone, a sample from each for the proper genetic combination is necessary.) Your family physician can take these samples in a simple office consultation.

We will endeavor to provide you with the combination in genetic make-up most closely matching your desires as set forth below. You should receive your clone after the normal nine month development period.

James R. Kemp, M.D.
Institute Director

UNAUTHORIZED CLONING IS A FEDERAL OFFENSE

						SEX M ☐ F ☐	
(last)		(first)		(init.)			
The following are characteristics you desire in your child (clone). Check appropriate boxes. Please type or use pen.							
SEX	MALE ☐		FEMALE ☐		RATE \$73.00		
HT. IN ADULthood	TALL ☐		MEDIUM ☐		SHORT ☐ \$61.00		
WT. IN ADULthood	OBESE ☐		NORMAL ☐		SLENDER ☐ \$52.00		
HAIR COLOR	☐ BLACK	☐ BROWN	☐ BLONDE	☐ RED	\$71.00		
EYE COLOR	☐ BROWN	☐ BLUE	☐ HAZEL	☐ BLK	\$72.00		
INTELLIGENCE QUOTIENT	Below 100	100-110 \$320	111-120 \$400	121-130 \$480	131-140 \$560	ABOVE 140 \$620	
Exceptional aptitude in selected profession. Please specify:							

PHYSICAL TYPE:

If desired, physical appearance can be cloned from cells in storage of the individuals listed below. Check one.

- | | |
|--|---|
| ☐ a. Mick Jagger | ☐ b. Johnny Carson |
| ☐ c. Orson Welles | ☐ d. Burt Reynolds |
| ☐ e. Henry Kissinger | ☐ f. Richard Nixon |
| ☐ g. Wilt Chamberlin | ☐ h. Raquel Welch |
| ☐ i. Jacqueline Kennedy | ☐ j. Kate Smith |
| ☐ k. Phyllis Diller | ☐ l. Angela Davis |

a, b, f, h, i, l

\$415

c, d, e, g, j, k

\$375

PSYCHOLOGICAL TYPE:

If desired, special talent and professional characteristics are available from cells in storage of the following individuals. Check one. Prices available on request.*

- | | |
|--|---|
| ☐ Albert Einstein | ☐ Mohammed Ali |
| ☐ Amelia Earhart | ☐ Leonard Bernstein |
| ☐ William Shakespeare | ☐ Francis Ford Coppola |
| ☐ Pablo Picasso | ☐ Sigmund Freud |
| ☐ Plato | ☐ Adolph Hitler |
| ☐ Howard Hughes | ☐ Golda Meir |
| ☐ Marilyn Monroe | ☐ Marie Curie |
| ☐ Tokyo Rose | ☐ Betsy Ross |
| ☐ Amenhotep II | ☐ Pope Pius (I-XII) |
| ☐ Mozart | ☐ Yoko Ono |
| ☐ Noble "Kid" Chisel | ☐ Doodles Weaver |

*Inquire for additional selections.

PERSONALITY PREFERENCES:

(Check one position for each scale.)

	1	2	3	4	5	6	
PASSIVE							AGGRESSIVE
DOMINANT							SUBMISSIVE
SHY							OUTGOING
VERY ACTIVE							VERY INACTIVE
AFFECTIONATE							NON-AFFECTIONATE
SENSITIVE							INSENSITIVE

FOR GOVERNMENT USE ONLY (43-67-J8)

APPROVAL: DEPT. A ☐ DEPT. B ☐ DEPT. C ☐

SUGGESTED ALTERATIONS:

A. SM-21 ☐ B. J5R-VB ☒ 439 C. U90-1 ☐

STATISTICAL

STATISTICAL

Litter Survey

Curriculum Topic

POLLUTION - waste caused by packaging of foods and materials

Subject

Science, Social Studies

Environmental Topic

ECONOMICS AND TECHNOLOGY - CULTURE

Grade Level(s)

6-9

Site

School, school grounds

Skills

Collecting and compiling data
Developing a plan of action

Author

Maryann Cronin Horgan

Objective

After completing a school litter survey, the students will be able to:

1. identify packages that can or cannot be recycled.
2. identify items that contribute to pollution.

To The Teacher

Depending on the weather, students will conduct a survey of the litter found in the school building or on the school grounds. This activity would be especially constructive if done concurrently with a clean-up project. The class might consider sponsoring a "Clean-Up Litter Day!" at school for other classes to join. Including a contest (for example, who found the most useful, most unique or most valuable litter) during the activity is a positive stimulus to doing a good clean-up job, and adds some competitive fun.

The Litter Survey will help students to organize and tally their findings as they work. Back in the classroom, all the results can be tabulated on the board, and discussion can begin with questions from the teacher. Example questions include:

1. What was the most common type of litter found? How can we help to stop this type of littering?
2. Were all the packagings you found really necessary to preserve the item until it was purchased? How could unnecessary packages be eliminated?
3. Where was most of the litter found? Could the class make some recommendations to the school to help solve this litter problem?

To show students that we should consider litter a serious pollution problem, it is important that their suggestions and solutions be sent along the proper channels for action. For example, the list of suggestions might be published in the school newspaper or sent to the principal.

Before You Begin

- Preparation:
1. Duplicate the Litter Survey Form for each student.
 2. Students will need garbage bags to collect litter and pencils.

Words To Know

litter, survey, recycle, disposable.



"I FIGURED IF YA CAN LICK EM, JOIN EM"

Conservation News

ACTIVITY

1. Divide students into teams.
2. Assign each team an area of school for collecting litter and data.
3. Teams will collect litter and record on the survey form the number and types of litter around the school.
4. As a class tally the results by combining survey data from each team on the chalk board.
5. Students will discuss their findings and list possible solutions to help eliminate the litter problem at their school.

Related Activities

1. Study the packaging of food products.
2. Make a bar graph of one type of litter found (e.g. cigarette brands or beer cans)
3. Start a Clean-up Day at your school.
4. Have a scavenger hunt as you pick up litter.

Notes To Myself

STUDENT PAGE

CHECK LIST FOR SURVEY OF LITTERBUGS

NAME _____

LOCATION _____

DATE _____

TIME _____

LITTER	TALLY	TOTAL
GUM WRAPPER		
CANDY WRAPPERS		
CIGARETTE PACKS		
CIGARETTES/FILTERS		
FRUIT PEEL/CORE		
SODA CAN		
NEWSPAPER		
BEER CAN		
BEER BOTTLE		
SNACK BAGS (E.G. CHIPS, FRITOS)		
NOTEBOOK PAPER		
OLD TESTS/HOMEWORK		
WINE/LIQUOR BOTTLES		
ICE CREAM WRAPPER/STICK		
FACIAL TISSUE		
OTHERS		

Bubble Gum Wrappers and Fritos

Curriculum Topic

POLLUTION

Subject

Science, Social Studies

Environmental Topic

ECONOMICS AND TECHNOLOGY -
CULTURE

Grade Level(s)

6-9

Site

Classroom

Skills

Measuring, defining problems,
locating and obtaining information,
evaluating information, identifying
alternatives

Author

Maryann Cronin Horgan

Objective

The student will be able to:

1. collect and analyze examples of packaging,
2. distinguish between necessary, unnecessary and wasteful packaging.

To The Teacher

Solid waste disposal and litter are two problems which plague most towns. In this activity, the student will analyze the issue of packaging and relate it to these problems. It is important that students see the packaging industry as being very necessary for protecting many of our foods, for example, vacuum sealed cans protect us from ptomaine and botulism, and bagging keeps flour and sugar from spilling and becoming insect-infested.

However, many foods do not need to be packaged at all. The teacher should bring in some examples of unnecessary packaging to prompt students to see that nature does an excellent job of packaging many of her own foods - apples, eggs, potatoes, nuts, oranges, etc. Also, students might offer different suggestions for many items that are packaged in cardboard and plastic (hammer, toy car) unnecessarily, and how we might all change our shopping habits, such as carrying our own bags or sacks for purchased items.

Being brought up in a "throw-away" society it might be difficult for students to see the wastefulness in some packaging, especially our convenience items. The following activity should help students see the wastefulness in over-packaging.

Before You Begin

1. Many examples of packaging (can, bottle, boxes, bags, bubble cards).
2. Index cards.
3. Convenience foods, lunchbox size packages and a large size of same product. (Frito's lunch box-sized bags and one large bag; individual sized pudding in cans; variety packs of cereal such as Kellogg's Variety or Quacker Instant Oatmeal; individually wrapped cheese slices).

Words To Know

packaging, convenience foods, recyclable, recycled litter, returnable, deposit, consumer



"IT'S EMPTY!"

Conservation News 8-15-73

ACTIVITY

1. Have each student bring in three different types of packaging (can, bottle, bag, box, wrappers). Have students use their judgment to bring in some over-packaged and some properly packaged materials.

2. In class, have each student answer on an index card the five questions listed below:

- a. Is this package needed? If yes, why? If not, why?
- b. Is this package too big for the item inside?
- c. Can this package be recycled? How? Will this package be recycled?
- d. Is this product a convenience item? Why?
- e. Could you have used something else and been less wasteful than buying this item?

3. Have each student staple this package to the bulletin board with the index card adjacent to it. Let the class have a day to read all the cards and think about each other's comments.

4. Lead a follow-up discussion to cover three main topics - necessary, unnecessary and wasteful packaging. See "To the Teacher" for some suggestions.

5. Have students work in small teams and concern themselves with one product. For example, one team could work with Frito's and another with Cream of Wheat or instant pudding. Have each team determine the ratio of food to packaging for two size packages - one large size and one lunch-box-size. Have them weigh the amount of food in grams in the large package. Then weigh all the packaging from the product. Determine the ratio of food to packaging i.e. $\frac{\text{wt. of food}}{\text{wt. of packaging}} = \text{ratio}$.

Repeat the process as described above for the lunch-box-size package that will make up the same weight of food as the large package. Determine the food to packaging ratio for the lunchbox size packages.

For instance, for Fritos use one large Frito bag of 16 oz. and eight 2 oz. packages.

6. Conduct a class discussion based on the results of your survey.

- a. Which is more economical - a large food to packaging ratio or a small food to packaging ratio?
- b. In each comparison, which type of package - family size (large) or set of lunch-box-packages - had the largest food to packaging ratio.
- c. Which type of package - family size or lunch-box-size - uses the most packaging?
- d. Is this packaging necessary, unnecessary, or wasteful in the family size? Lunch box size?

Related Activities

1. Hold a debate in class concerning "returnable bottles vs. no-deposit-no-return bottles (and cans)".
2. Write an essay "How the Shopping Cart Changed Our Lives".
3. Interview an older person and find out how they did their shopping and what packaging practices were like 50 years ago.
4. Try to recycle left over packaging items into useful items (e.g. make a bird feeder out of an aluminum pie plate).
5. Take a survey of the school litter caused by packaging.

Resources

(Litter Survey Activity in Infusion Notebook)

Credit

It's Your Environment, ed. S. Koehler, Charles Scribner's Sons, New York, 1976 EEC #818 (activity of measuring wastefulness in packaging of convenience foods; easy reading for students, good background for teacher).

Notes To Myself

417

ENVIRONMENTAL QUALITY



ENVIRONMENTAL QUALITY

<u>ACTIVITY TITLE</u>	<u>PAGE NUMBER</u>
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CARCINOGENS IN THE ENVIRONMENT.....	441
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ENVIRONMENTAL QUALITY

Most animals are at their functional peak when environmental conditions are kept within certain narrow limits. For example, if the water around a fish is either too hot or too cold, the fish will die. But it has been found that if a fish is raised in water that is slightly warmer than its usual optimum, it can tolerate slightly higher temperatures than other members of its species. This ability to adapt to conditions other than those the organism has adapted to is called acclimatization. We humans do it too. When one enters a busy secretarial office, one is immediately affronted by the clatter of many electric typewriters. But after an hour or so working in such an office, one becomes so used to the noise that it is disturbing if all typewriters are turned off. Of course, there are limits to our adaptability--if the atmosphere were to rapidly become dominated by carbon dioxide and sulfur dioxide instead of nitrogen and oxygen, we would all be dead, and natural selection would not operate quickly enough to evolve new lungs to respond. But since we can tolerate a very broad range of environmental conditions and still not only function but apparently thrive, the meaning of "environmental quality" is not always very clear.

Certainly, environmental quality does not mean a complete return to the pristine, pre-human environment. The air and water might be cleaner but it would be awfully unpleasant to dress in loincloths, live in caves and compete with the tigers for food. Many economists don't even think that reducing environmental pollution to zero would mean achieving the greatest possible environmental quality. They feel that the costs involved in reaching such an idealistic goal outweigh the benefits. And most of us are probably not consciously aware of the most blatant environmental deterioration in our everyday lives. We accept the noise of jackhammers, the slight stinging of the eyes, the dull grey tint on our buildings as normal concomitants of urban existence. But we do know, at least in the abstract, that there is another way--albeit remote--to exist; a way in which humanity modifies nature to a minimal extent and the ecosystem is essentially undamaged by human activity. In a world in which all environmental decisions involve tradeoffs, this appears to be the ultimate one: we can achieve perfect environmental purity, but only if we are willing to sacrifice art, electricity, the division of labor, and everything we commonly think of as "human". Obviously the happy medium lies somewhere between the world of the Bushmen and the world of Tokyo, London, and New York.

There are two views of environmental quality. One views the ultimate in quality as that which nature granted us, and any intervention by man is disruption of the natural balance and environmental deterioration. The other views the environment as existing simply to provide human needs, and any modification which makes life easier for people means an increase in environmental quality. It would seem impossible to reconcile these dichotomous views--one sees humankind starting at infinite environmental quality and subtracting from it toward zero, while the other sees the start at zero environmental quality which man adds to steadily, with an infinite potential for improvement.

Yet reconcile these views we must. On the one hand we must respect all living things and know that we can never build a completely synthetic environment that will replace the natural one. We are, even in our cities, dependent upon natural gifts--the chlorophyll in green plants, the oxygen in the air, the fossilized creatures that form our petroleum, coal, and natural gas. At the same time we must recognize that people's needs and desires have gone beyond simple survival, and that the human-made environment is an important expression of human creativity. It is thus our responsibility to remember that a quality environment means the possibility for each individual to achieve his or her fullest human potential.

Preserving environmental quality means preserving wilderness, protecting endangered species and not polluting lakes. It also means harvesting trees, keeping pests from our food, and restocking lakes so they can be fished. It further means feeding the world's poor, educating the illiterate, and keeping the cities as quiet, clean and healthful as possible. The goal is no longer simply the greatest good for the greatest number. We must achieve the greatest good for the greatest number with the proper respect for the natural systems on which we all depend, and with the proper respect for the thought, creativity and independence that makes Homo sapiens a unique species.

-Steve Gold

Who is Killing the Ponderosa Pines?

Curriculum Topic

CIVICS AND CITIZENSHIP

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

Adaptable

Site

Classroom/Neighborhood

Skills

Recognizing problems,
locating and obtaining
information, generating
alternate solutions

Author

Cyndi Walsh

Objective

The student will be able to;

1. list the causes of city pollution and its effect on the quality of life.

To The Teacher

Air pollution in cities has caused severe health problems and damaged plants and trees. Since plants renew the air in a closed system, such as earth, this is a vital concern to all. Poor air quality today is caused by a lack of foresight in planning cities (industrial centers). The harmful effects of technological progress can seem of little consequence compared to the many benefits of technology. But, it is essential to build an awareness of the causes and resulting effect of poor air quality as well as a responsibility to maintain high standards of air quality. Incidents of helpless populations trapped by poor air quality are numerous.

In 1948, Donora, Pennsylvania mills and factories poured sulfur dioxide, coal smoke and other gases into a fog, leaving the air smelling like rotten eggs. Thousands of people suffered from sore throats, headaches, stomach aches and burning eyes. Twenty people died from this dirty air that stayed foggy and polluted for four days. In the 1950's and 1960's similar conditions in London and New York killed thousands of people.

Awareness of such problems is growing. Radios broadcast the air quality index and recommend activities for the day. Air quality standards bureaus watch and report on level of particulates and smog in city limits. These procedures seem to convey an acceptance of city and suburban life.

In this activity students will explore the causes and ways to prevent poor air quality on a private, individual level as well as a legislative one.

Before You Begin

Materials: poster paper, art materials (pencils), science resource books, assorted reference library books and periodicals on air pollution

Words To Know

particulates, convection currents, smog, methane, propane, nitrogen oxide, density, pollutants, respiratory, filter



ACTIVITY

1. Preview the presentation topics at the end of the Ponderosa Pine story. Select those adaptable to your groups.
2. Divide class into groups accordingly.
3. Read aloud the "Ponderosa Pine" story.
4. Assign each group a different presentation topic from the list.
5. Each group is to act as concerned forest rangers as they research and present their air quality topic to a "board of the city council."
6. Allow for presentation time.
7. After all presentations are given, ask the class to vote on the most persuasive group with the most thought-provoking and effective presentation. (Pretend city council may be parents, teachers or another group of students.)

Related Activities

1. Write letters to your representatives in Congress. Ask them to be sure that the Clean Air Act is enforced and obeyed.
2. Insist that auto makers design a clean burning car engine.

Resources

Oswald, J., Planet Earth, Houghton Mifflin Social Studies Program, 1976.

Credit

ECO-NEWS, Environmental Action Coalition, 156 Fifth, Ave., Suite 1130
New York, NY 10010.

Drawing: Cecelia Zych

Notes To Myself

STUDENT PAGE

PONDEROSA PINE

As a park ranger you are aware of the dangers of air and water pollution to wildlife in our nation's parks and forests. You believe that the pollution from a neighboring city has caused damage to the Ponderosa pine trees. You have noticed that the long needles that collect carbon dioxide and nitrogen from the air have lost their healthy, dark green color. The weaker trees have turned yellow because they need the gases to breathe and make food. Many will die if the cause is not determined.

Many people think that an insect or disease may be attacking the pine trees. You must convince them that the real problem is automobile exhaust and industrial pollution from a city 60 miles away.

The city council has planned a hearing to determine potential pollution problems. Each group of park rangers will make a chart and poster presentation explaining one aspect of the pollution problem. They will then attempt to convince the town council that air pollution has resulted in tree damage. The topics are as follows:

1. The gasoline engine: carbon monoxide and other wastes come from incomplete combustion in the engine, up to 3 lbs. per gallon of gas from the exhaust pipe of an efficient gas engine car exhaust system. You may:

- a. illustrate findings in a dramatic poster (i.e. weight of exhaust from a full tank of gas).
- b. compare standard size vs. compact car
- c. demonstrate how a gas engine works.
- d. compare gasoline to diesel engine.
- e. talk or write to automotive manufacturers to determine what is being done to reduce exhaust
- f. invent a pollution-free car

Convince the town council that overpopulation by the automobile has a profound impact on air quality.

2. Draw the $\text{CO}_2 - \text{O}_2$ cycle showing how the pines would normally get the gases they need for food and respiration. Using a different color pencil show how the car exhaust in the cycle affects the food making ability of the Ponderosa pine.

3. Draw a diagram showing how car exhaust and pollution from the problem city can flow up into the mountains by convection currents and thus damage the pines. (Use the land-breeze and sea-breeze theory)

4. Show how smog is formed. When gasoline is burned, methane and propane are created. These gases are not usually harmful by themselves. But when they combine with nitrogen oxides and soot they form smog. (Air pollution we can see.) It often looks yellow-brown and seems to hang in the air. Explain the process to the council.

5. Factories, electric power plants and incinerators cause air pollution. Make your own darkness key to determine colors of smoke from stacks. Lightest to darkest smoke.

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Measure the darkness (or density) of the smoke coming from smokestacks in the city by comparing it to a density chart you have made. Check the smokestack at different times of the day. The darker the more harmful gases and particulates (bits of ash and soot) it will have in it. Present your findings to the town council.

6. Make a particulate count of the air environment. Attach a loose strip of tape to the outside of a piece of cardboard. Attach this to the outside of a window. Check the tape with a magnifying glass to see the pollution in the area at different times during the day. Report to the council.

7. Air pollution is also unpleasant because it dirties walls, windows, and clothes. Other pollutants can kill plants and harm the animals that eat plants. Pollutants can become part of the rain and form strong acids that eat away at metal and stone buildings and damage pine trees.

8. Many industries that burn fuel now use pollution control devices. These new inventions clean air in the smokestack. As people become more concerned about the environment, government and industry will seek new ways to control the pollution problem.

For your presentation to city officials, prepare a poster or models that show the new pollution control devices that should be used to protect the forest:

- a. Fabric Filter - takes dirt out of the air as it passes up the smokestack. Fiberglass is the best material but other fabrics have been successful.
- b. Scrubber - removes dirt particles that the fabric filter removes and also removes most of the poisonous gases (sulfur and nitrogen oxides). It sprays a liquid on the pollutants that traps the gases and carries them away before they can escape out of the smokestack.

Pollutants removed by the scrubbing process form a paste-like liquid. It is sometimes put into landfills or in special ponds. The poisonous sludge often seeps out into the ground. This causes another kind of pollution problem for the drinking water. Science has discovered a special chemical to make the sludge into a non-polluting dry cake. This has been used in the newer scrubbing systems. Researchers are trying to turn cakes into building materials so that waste can be made useful. Perhaps you can brainstorm another way of using these pollutants removed by the scrubber.

Environmental Enemies

Curriculum Topic

POLLUTION

Subject

Science

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

7 - 8

Site

Classroom

Skills

Valuing skills: defining alternatives
making choices

Author

Pat Perrella

Objective

Students will be able to:

1. rank six environmental problems according to their severity
2. identify their own contributions to environmental problems.

To The Teacher

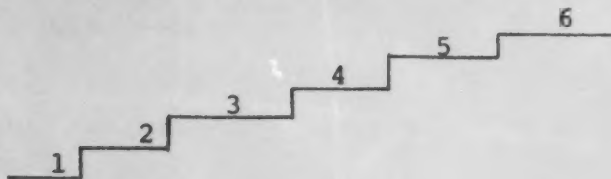
When using activities to clarify students' values, the teacher should be aware of the valuing process itself. A willingness to prize and cherish beliefs, to publicly affirm beliefs when appropriate, to freely choose beliefs after examining alternatives and considering the consequences, and finally, to act consistently upon these beliefs may indicate that an individual has developed a value system. This activity challenges students to define and confront the values they hold on environmental issues.

Before You Begin

Caution: Be as non-judgemental as possible. If asked about your own opinion, try to answer according to your own value system, identifying it as such. In discussion question 3, do not force reluctant students to share their work. Rather, encourage these students to evaluate their responsibility as caretakers of environmental quality.

ACTIVITY

1. Ask students to construct a ladder with 6 numbered steps:



*The ladder should be large enough to fill an entire page.

2. Read the example situations below. Each describes an "environmental enemy." Students are to identify the enemy (e.g., the hiker) and write this key word on the appropriate step of the ladder.
3. Students rank each enemy as least harmful (1) to most dangerous (6).
4. Students may cross out and change their rating as each new statement is read.
5. When all the statements have been read by the teacher and ranked by the students, divide the class into small groups of three or four to compare and discuss their responses.

THE ENVIRONMENTAL ENEMIES

I. Mr. Thompson is a junior high school teacher who is very concerned about his students. He knows that many of them smoke cigarettes and he has introduced several lessons in his class attempting to show how harmful cigarette smoke is to the human body. He himself started smoking in high school and, although he has tried several times to quit, he continues to smoke. Between classes, Mr. Thompson rushes to the teachers' lounge where many non-smokers are gathered, has a quick cigarette, then rushes back to class, leaving behind a thick cloud of smoke. (Key Word: smoker)

II. The owner of a factory in a single factory town knows that the smoke from his smoke stacks is a major source of pollution in the area. He investigates the cost of installing anti-pollution devices and discovers that he would have to lay off about fifty people from the town in order to pay for these pollution controls. He weighs the decision carefully and decides that he will keep the workers and not install the anti-pollution devices. (Key Word: factory owner)

III. A group of energetic high school students plan a day of hiking in a scenic mountain area. When they come upon a huge boulder, they show their school spirit by spray painting their school's name on the boulder. (Key Word: hikers)

IV. Mrs. Franklin is very careful about turning off electrical appliances when they are not in use. She conserves water and does not litter the environment. She keeps her car well-tuned so as not to add any unnecessary exhaust fumes to the atmosphere. However, Mrs. Franklin spares no expense in heating her home. During the winter, she sets her thermostat at 80 degrees F. "I do my share," says Mrs. Franklin. "Someone else can worry about conserving heat." (Key Word: home heater)

V. At a public appearance, a prominent politician running for office promises to promote mass transit if elected. "In this way," he says, "we can conserve gasoline, improve air quality, and eliminate traffic tie-ups." After the speech, the politician gets into his limosine and drives away. (Key Word: politician)

VI. The owner of a small farm knows that the insecticides he uses are illegal, but he has been using them for years and grows beautiful vegetables. Discontinuing use of the insecticide now would be risky, especially now, when he is just managing to make ends meet. (Key Word: farmer)

Questions for Discussion:

1. Discuss in your group your reasons for placing the environmental enemies on the ladder in the order you chose.
2. The offenders in these situations are not major environmental criminals. Do you believe that we should be concerned about individuals polluting the environment when more serious offenders such as large industries are often unprosecuted? In other words, what do you feel is the role of the individual in maintaining the quality of the environment?
3. Anyone of us can be called an environmental enemy to some degree, just by the nature of our life styles. Take a few minutes to write a paragraph in which you describe how you yourself might be considered an environmental enemy. When you have finished, read the paragraphs within your groups. (optional)

Related Activities

After the small group discussion, students might want to continue with the entire class in order to hear more points of view.

Resources

Raths, L., M. Harmin, S. Simon, Values and Teaching, Charles E. Merrill Publishing Co., 1966

Simon, S. L. Howe, H. Kirschenbaum, Values Clarification, Hart Publishing Co., 1972, pp. 98-111

Notes To Myself

Determining a Biotic Index

Curriculum Topic

OCEANOLOGY & LIMNOLOGY

Subject

Science

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

7

Site

Stream

Skills

Collecting and compiling data

Author

Carla McGeeney

Objective

The students will be able to:

1. classify organisms which have been collected at various locations in a stream according to their levels of tolerance to pollution.
2. calculate an approximate biotic index which reflects the healthiness of the stream.

To The Teacher

One way to determine the health of a stream is to determine the amount of oxygen available to organisms. A large amount of dissolved oxygen in a stream can support a diversity of organisms. The stream is then considered a healthy one. If there are many kinds of animals (high diversity), the stream is considered a more stable environment.

Certain species of organisms require a higher level of oxygen than others. We call these organisms "sensitive" or "intolerant" organisms. We put all organisms of this type in class I. Organisms that are capable of living under varying conditions of dissolved oxygen we put into class II.

Organisms which are tolerant of extremely harsh environmental conditions are characterized by low levels of dissolved oxygen. These are labelled among class III.

To establish a biotic index, use the following formula: $2 \times \text{number of different kinds of class I organisms} + \text{number of different kinds of organisms in class II} = \text{biotic index}$. Since class III organisms are so tolerant of polluted conditions they are not used in the formula.

Before You Begin

Materials: sieve, tweezers, glass or plastic jars, eye droppers, collecting bottles, formalin

Preparation: Make a copy of the student page (benthic organisms listed according to classes) for each student or student team.

Remember to have students collect from 3 areas of a stream: the rapids, pool bottom, muddy edges. Be sure students count the number of kinds of organisms, not merely the number of organisms.

Words To Know

Benthic organism, tolerance, biotic index



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ACTIVITY

1. Distribute one piece of collecting equipment to each student. Assign each student an area of the stream: rapids, pool bottom, and muddy edges of the stream.
2. Have each student take several sweeps through the water to collect organisms. Place all organisms in collecting jars that are then properly labelled according to place from which the organism was taken.
3. Have the students bring the samples back to the classroom where they are to be preserved in a 10 per cent formalin solution.
4. Direct students in the use of dissecting scopes. Help them determine the type of organisms collected by using the charts provided on the Student Page. Other books on stream organisms would also be helpful, as the drawings on the chart show only one stage in development of that organism. The same organism may look very different at different stages.
5. Ask each student to count the number of different kinds of organisms collected which belong to class I. Do the same for class II. Using the following formula, have students calculate the biotic index.
$$2(\text{class I}) + \text{class II} = \text{biotic index.}$$
6. Questions for discussion or for written exercise:
 - a. What is a biotic index?
 - b. What is the range of biotic indices?
 - c. Where does our stream fall? Why?
 - d. What would you expect if you sampled the stream in the fall? Summer? Spring? After a rainfall? In draught?
 - e. Did you, or should you, remove trash from the stream? Discuss both pros and cons of this issue.

Related Activities

1. Describe the life cycle of one of the organisms that you found. Draw pictures of various stages. Why are class III organisms not included in the formula?
2. Using a water-test kit, determine the level of dissolved oxygen.

Credit

"Watershed Heritage: Environmental Education for Secondary School Students," Institute for Environmental Education, Cleveland, Ohio 44106, EEC #215.

Notes To Myself

BIOTIC INDEX BENTHIC ORGANISMS

C
L
A
S
S

1



CADDISFLIES



MAYFLIES



STONEFLIES



HELLGRAMMITES

AQUATIC BEETLES:



FRESHWATER CLAMS



"WATER PENNY"



RIFFLES BEETLE

C
L
A
S
S

2



DAMSELFLIES



DRAGONFLIES



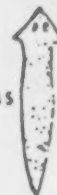
CRAYFISH



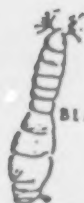
GILL SNAILS



FINGERNAIL CLAMS



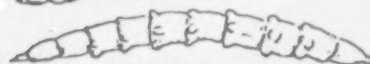
FLAT WORMS



BLACKFLY



CRANEFLY



HORSEFLY



AQUATIC SOWBUGS

C
L
A
S
S

3



MIDGES



AIR BREATHING SNAILS



LIMPETS



MOTH FLIES



LEECHES



RAT-TAILED MAGGOT



AQUATIC EARTHWORMS



MOSQUITOES

Carcinogens in the Environment

Curriculum Topic

BIOLOGY

Subject

Science

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

6-12

Site

Skills

Locating and obtaining
information; communicating
information (orally and written)

Author

Maryann Cronin Horgan

Objective

The student will be able to:

1. list five types of cancer, their environmental causes, and potential treatments (if any).
2. suggest ideas for prevention of cancer caused by environmental factors.

To The Teacher

There has been a shift in disease patterns in the United States from the 1900's, when most people died from infectious diseases, to the present time when heart disease and cancer account for more than half of our mortality.

The detailed biochemical mechanisms by which cancers develop are not understood. However, according to one widely held theory, it is the reaction with DNA and RNA that cause a substance to be carcinogenic. Cancer may be considered a single disease in the sense that all cancer is characterized by unrestrained growth of cells. The exact causative factors of observed cancer cannot always be defined, but the most prominent factors appear to be hereditary, viruses, and environmental. It is estimated that 60 to 90 percent of all cancer is related to environmental factors. For example, the increasing rate of emphysema and lung cancer is linked to air pollution. Most people blame cigarette smoking as the cause of lung cancer but just to live in many of our cities is equivalent to smoking a pack and a half of cigarettes a day. The United States has twice as many cases of lung cancer per thousand as Norway, a country relatively free of air pollution.

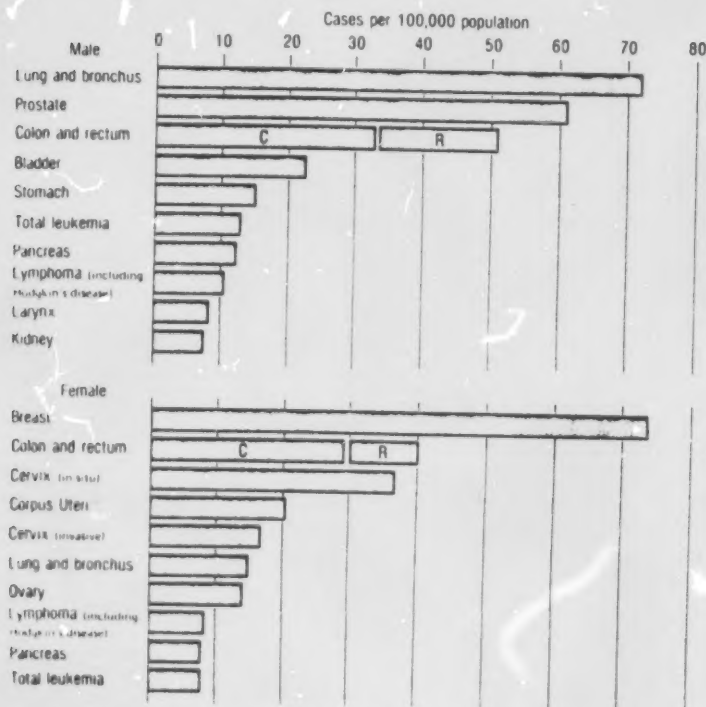
Before You Begin

Materials: Preparation: This activity may follow a lesson on normal cell division and activities such as labeling a typical cell, microscope work, identifying chromosomes, etc. Then the teacher may use as many different materials as are available to show how cancer is the uncontrollable and abnormal growth of cells, often caused by environmental conditions. This will be a good time to clear up any false ideas or myths.

Words To Know

carcinogen, cancer, teratogen, mutagen, additives, pesticides, insecticides, tumor, sarcoma, carcinomas, leukemias

Cancer Incidence, by Site and Sex, 1969-71
(age-adjusted to 1970 U.S. population)



Source: David L. Levin et al., *Cancer Rates and Risks*, DHEW Pub. No. (NIH) 75-891 (2d ed., Washington: D.C. Government Printing Office, 1974), Figure 6.

TYPES OF CANCER

sarcomas - in connective tissue, including bone

carcinomas - in cells lining the internal and external surfaces
(lung, breast, skin)

leukemias or lymphomas - in cells that compose blood system

ENVIRONMENTAL CAUSES OF CANCER

WORK RELATED

coal dust
asbestos fibers
lead particles
uranium radiation
chemical fumes
pesticides
glass fibers
soot
benzidine (dyes)

AIR POLLUTION

sulfur oxides
sulfuric acid
sulfate particles
asbestos
beryllium
mercury
lead
pesticides
cigarette smoking
vinyl chloride

WATER POLLUTION

nitrates (fertilizers)
sodium
raw sewage
industrial wastes
oil
insecticides
arsenic
mercury
lead

RADIATION

medical and dental x-ray
fall-out from nuclear testing
uranium mines
nuclear-powered generators and fuel-
processing installations
radioactive isotope research
microwave ovens
color TV
lasers
sunburns
natural background radiation

FOOD ADDITIVES

preservatives
dyes
flavor enhancers

DRUGS

thalidomide
LSD

ACTIVITY

1. Have students "brainstorm" in small groups or as a class CANCER.
2. The class should categorize their topics from brainstorming on the blackboard headings (see To The Teacher):

types of cancer

environmental causes
of cancer

treatment

3. The teacher may lead the class in various activities to gain further information on environmental causes of cancer:
 - a. lecture and discussion
 - b. prepared slides of normal cells and diseased cell tissue
 - c. film strips, movies, transparencies
 - d. newspaper and recent magazine articles on animal studies for cancer research; new findings about food and drugs
 - e. personal interviews with people who have or have had cancer
4. Students should each select and research one topic from class lists, reporting back to the class on their findings.
5. Class will generate a list of suggestions regarding cancer prevention, by citing ways to check the suspected environmental cancer-causing factors and possibly offering alternatives to their use (e.g. using pheromones and natural predators instead of insecticides).

Related Activities

1. Invite a speaker from the American Cancer Society to speak to class.
2. Write for free information from different agencies (see Resources)
3. Create posters for community on "Cancer's Warning Signals."
4. Construct a bulletin board display for news articles on cancer research.
5. Read all or parts of Silent Spring by Rachel Carson.
6. Encourage class to write letters to newspapers or town government about pollution concerns or specific practices which the students consider dangerous to their health.

Resources

"Environmental Quality", the Sixth Annual Report of the Council on Environmental Quality, Washington, DC, 1975, EEC #G48 (ch. 1 Carcinogens in the Environment; teacher resource)

"Health Effects of Environmental Pollution", EPA, Washington DC, 1975. (only 17 pages; easy reading for students)

Eblen, William, Total Education in the Total Environment (TETE) an Ecology Series, Pendulum Press, Inc., West Haven, CT, 1971. (four small books for students on water pollution, air pollution, overpopulation, and pesticides; readable, pictures, questions)

Dubos, Rene, Maya Pines, Health and Disease, Time-Life Books, New York, 1970, p. 84 and 98.

Sources for Information:

Department of Health, Education and Welfare, Office of Environmental Affairs, 330 Independence Avenue, SW, Washington, DC 20201.

Environmental Health Service

Bureau of Occupational Safety and Health

Environmental Protection Agency, Office of Fed. Act., 401 M Street, SW Washington, DC 20426.

National Cancer Institute

Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20852

American Lung Association, 1740 Broadway, New York, NY 10019

Notes To Myself

Sick Air

Curriculum Topic

POLLUTION

Subject

Science
Social Studies

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

7, 8

Site

Classroom

Skills

Collecting and compiling data
Interpreting and inferring from data
Predicting

Author

Carla McGeeney

Objective

The students will be able to:

1. state three reasons why refuse burning is forbidden by law
2. identify a number of air pollutants.

To The Teacher

Air pollution is a major problem in the U.S. Cars are the major source of pollution, but only one of many sources as indicated by the chart below. By reducing any or all of these, the quality of air will improve.

POLLUTANTS (billions of kg)

Source	Carbon monoxide	Hydro- carbons	Nitrogen oxides	Sulfur oxides	Solid par- ticulates	Total by source
Transportation (cars, trucks, buses, etc.)	58.1	15.9	6.9	0.3	1.1	82.3
Electrical power plants and heating	1.7	0.6	6.0	20.6	8.3	37.2
Industry	9.6	3.2	0.2	6.5	6.9	26.4
Refuse disposal	6.9	1.5	0.5	0.1	0.9	9.8
Misc. (forest fires, etc.)	15.2	7.4	1.6	0.6	8.7	33.5
Totals	91.5	28.5	15.2	28.1	25.9	189.2

The burning of flammable material adds solids, liquids or gases, some of which are poisonous and even deadly, to the air. To anticipate the effects of open burning by knowing the by-products of combustion and their effects upon the air, we become participants in an effort to improve the quality of that piece of nature we cannot see and cannot live without.

Before You Begin

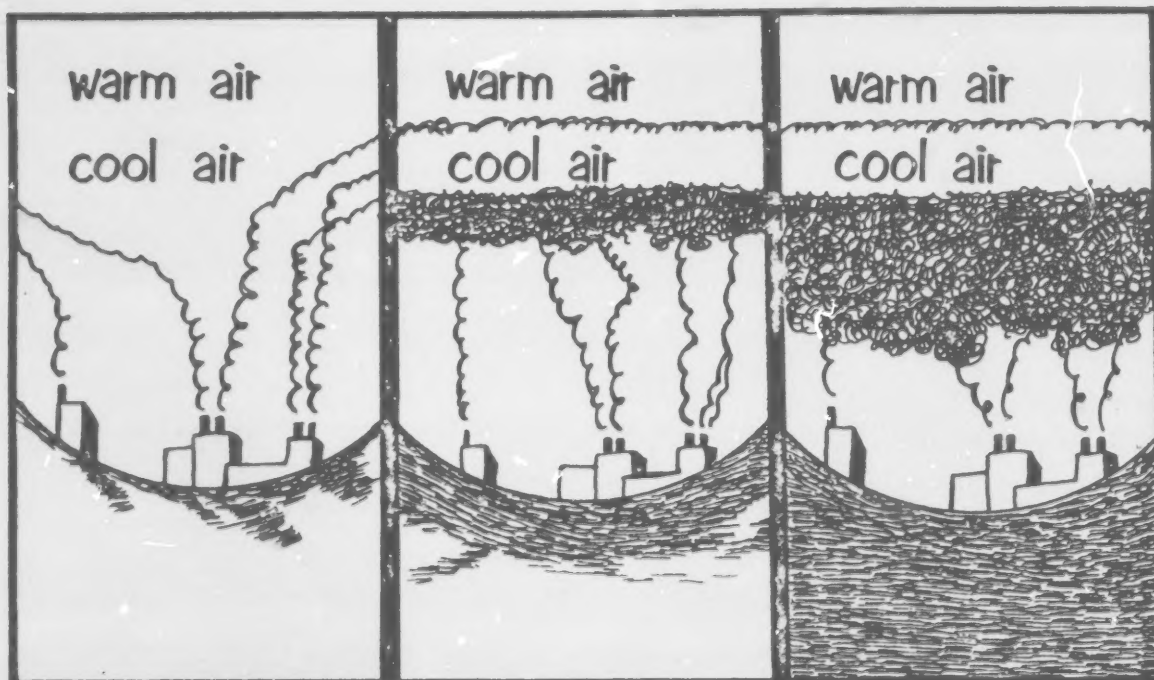
Assemble the following materials for each team of students:

a book of safety matches
600ml beaker or jar
baby food jar lid or small metal dish
2 small wads cotton
1 small piece wool cloth

small piece styrofoam
small piece rubber tubing
dried dead leaf
dropper bottle of turpentine
asbestos pad or sheet of white paper

Caution: Provide good ventilation for the room in which the activity is performed.

Notes To Myself



Normal Mixing

Temperature Inversion

ACTIVITY

Instruct each team to:

1. Place a small piece of cotton in the center of the metal dish and set dish on a white notebook paper labelled "cotton". Set the cotton aflame with the match, and cover immediately with the beaker. If the flame begins to die, lift the edge of the beaker to allow more air to flow in. When the flame dies, study the by-products of burned cotton left on the white paper and on the beaker. On worksheet provided, record changes in color, odor, and state of matter (solid, liquid, gas).
2. Repeat these steps using cotton moistened with 2 drops of turpentine. Label the paper "cotton-turpentine." Have them record observations as above.
3. Repeat this procedure substituting cotton with rubber, wool, styrofoam, and a leaf. Be sure to label the white piece of paper appropriately each time in order to compare results.
4. Discuss the following questions:
 - a) Which materials do you think would cause the most air pollution when burned?
 - b) Which burning materials gave off poisonous carbon monoxide? (Unless they know that they are styrofoam, rubber and turpentine, students will be unable to answer. Point out that the inability to readily identify CO, which is both invisible and odorless, is one of the dangers associated with it.)
 - c) In doing this activity did you add to the air pollution problem?
 - d) Many cities and towns are converting from open burning to a closed burning system. List reasons for this change.
 - e) Why do you need a permit to burn leaves? Do you know during which months you can burn your leaves? Why are certain months worse for burning than others?

Resources

"Environmental Science," Natural World Modules, Silver Burdett, First Edition

Credit

See Paul Kubicza's "Carbon Monoxide - A Dangerous Gas", in this notebook.

STUDENT PAGE

STUDENT WORKSHEET

MATERIAL BURNED	COLOR AND ODOR OF SMOKE	DESCRIPTION OF REMAINING PRODUCTS	OTHER OBSERVATIONS
COTTON			
COTTON AND TURPENTINE			
WOOL			
STYROFOAM			
RUBBER			
LEAF			

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473

Carbon Monoxide — A Dangerous Gas

Curriculum Topic

SAFETY

Subject

Science

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

7, 8

Skills

Observing
Listening and comprehension

Site

Classroom
School parking lot

Author

Paul Kubicza

Objective

The student will:

1. describe the sources of carbon monoxide
2. describe the effects of carbon monoxide on living things.

To The Teacher

Carbon monoxide (CO) is a colorless, odorless, tasteless gas that is slightly lighter than the combination of gases which we refer to as "air". CO can asphyxiate a living organism noiselessly and within minutes. A product of combustion, it is also the most abundant of air pollutants.

More than 94 million tons of carbon monoxide are produced annually in the United States alone. The air of most U.S. cities contains 50 parts per million (ppm) of CO and of the high content of CO in our air, 78 per cent is produced by automobile exhaust.

Carbon monoxide acts on the body by way of the hemoglobin, the substance which carries oxygen in the blood. Having 210 times the affinity for hemoglobin that oxygen does, CO is able to displace the oxygen in the hemoglobin and combine to form carboxyhemoglobin (COHb). The resulting lack of oxygen in the blood and circulatory apparatus eventually affects not only the tissues but all organs of the body.

As carbon monoxide is absorbed by blood in increasing quantities, symptoms of CO poisoning appear. The early stages of CO poisoning are characterized by headache, dizziness, and sleepiness. As more CO is absorbed, symptoms include nausea, vomiting, heart palpitations, and, finally, unconsciousness and death. If exposure is brief, recovery may be complete, but, prolonged exposure may cause brain damage to a victim from lack of oxygen.

Each year, 1,500 Americans die from carbon monoxide poisoning. About 900 of these deaths occur in the home. Many of these deaths could be prevented if people were more aware of the dangers of CO. Most people come in contact with many sources of CO daily. Any fuel-burning equipment, such as heating or other appliance, an automobile or gasoline-powered lawn mower is a potential hazard. In the case of gasoline, complete combustion requires the oxidation of gasoline to produce carbon dioxide and water ($C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$).

Incomplete combustion takes place, however, when the supply of oxygen is insufficient. In this case, both carbon dioxide and carbon monoxide ($C_7H_{16} + 10O_2 \rightarrow 2CO + 5CO_2 + 8H_2O$) are produced. Carbon monoxide is also one of the products of incomplete combustion of coal, propane, kerosene, fuel oil, natural gas and other fuels.

This activity requires the collection of automobile exhaust to demonstrate its effect on insects. If you feel that an experiment of this nature needlessly destroys life, this activity is not for you. The author feels that the potential for saving human lives in teaching the dangers of carbon monoxide is worth the sacrifice.

Before You Begin

Materials:

1000-ml Erlenmeyer Flask
#9 2-hole rubber stopper
2 copper tubing bends, 3/8"
or
2 large diameter glass bends
bucket

sand
small chair or box
2 corks
insects
automobile

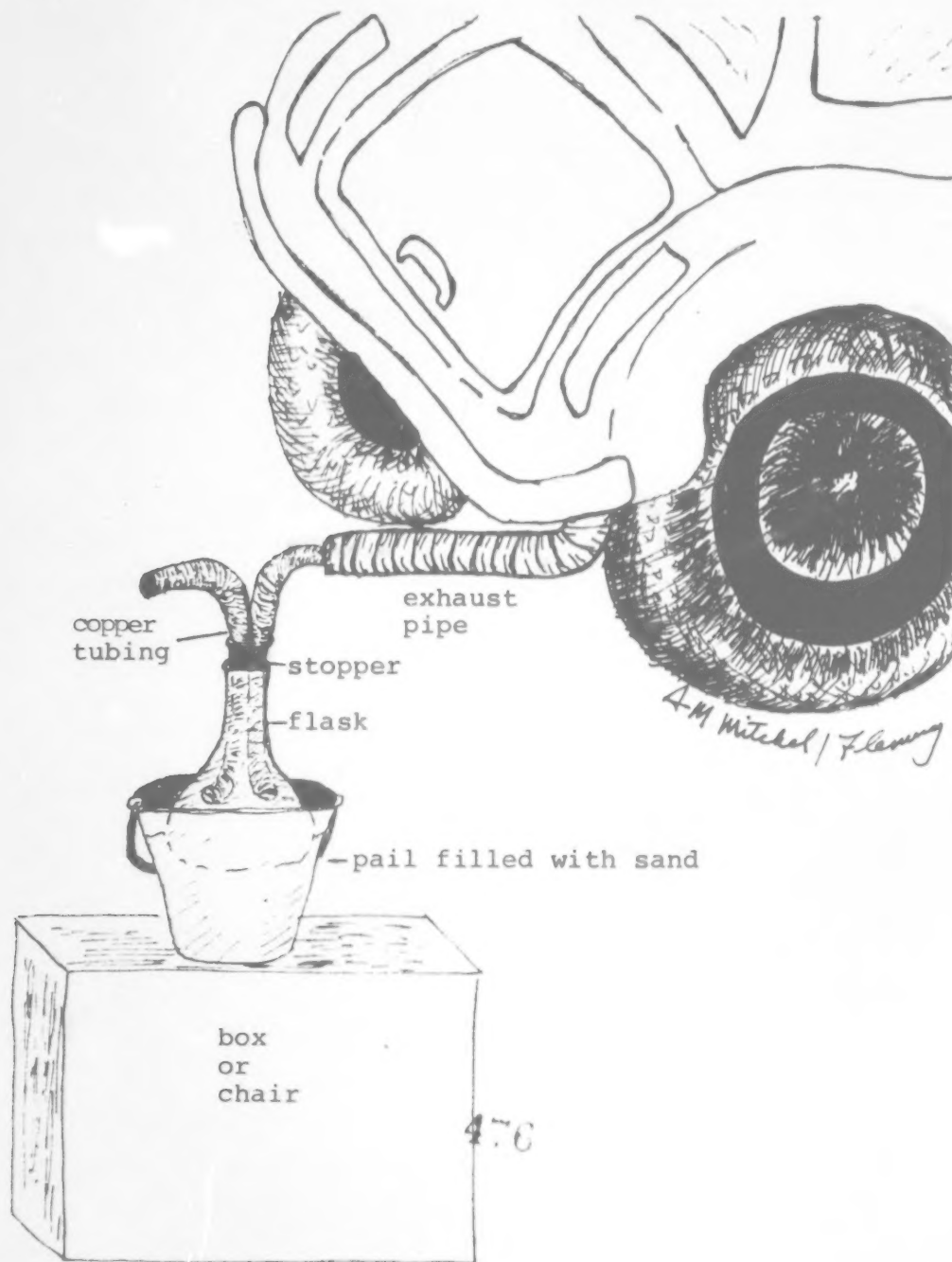
Preparation:

1. Insert both pieces of tubing through the rubber stopper. Enlarge stopper holes to fit tubing tightly.
2. Insert stopper into flask.
3. Half fill bucket with sand. Place flask into bucket. Cover flask with sand. This will act as a support for the CO collector.
4. Set the bucket on a chair or box so that the tubing can fit into exhaust pipe of a car. You may have to raise or lower the flask by putting boards under the bucket to raise it, by removing sand to lower it.

5. Run the car for a couple of minutes to practice collecting the exhaust.
6. Arrange for another teacher to help you carry out the activity. One teacher will run the car while the second keeps students at a safe distance - in particular, away from the front or rear.
7. Catch a few insects for the experiment.

Words To Know

carbon monoxide, combustion, hemoglobin, asphyxiation



ACTIVITY

1. Explain procedure to class: a) How you will collect auto exhaust, and b) How you will test its effect.
2. Show class the collector and explain how it will be used. Caution all students that they must stand to the side of car.
3. Take class out to parking lot.
4. Set up collector behind exhaust pipe.
5. One teacher will start the car and run it for 3-5 minutes while the second teacher supervises the class.
6. Shut off car.
7. Cork the tubing.
8. Return to class.
9. Place insects in the flask and observe results.
10. Discuss the production of carbon monoxide and its effects on living things. The following questions may be of value;
 - a) What effect does CO have on insects?
 - b) Do you think CO has the same effect on humans?
 - c) How is CO produced?
 - d) What machines or devices burn gasoline, coal, natural gas or other fuels?
 - e) Do you think CO production is a major problem?
 - f) What safety rules would you propose for operating an automobile, gas grill, and gas heater?
 - g) Why are so many people killed every year by CO poisoning?
 - h) What effects does CO production have on air quality?
 - i) Why is it a good idea to have the exhaust system of an automobile checked every year?

Related Activities

1. Obtain and use a CO analyzer available from the Connecticut Christmas Seal/Lung Association.
2. Have students make up safety posters for display in the room and school.
3. Obtain statistics on the number of cars, trucks, and buses in America. Discuss the magnitude of the CO produced by these vehicles.

Resources

- Bockel, Jeanne, "The Elusive Polluter," Science News, Nov. 22, 1969, pp. 480 - 481
- "CO", U.S. Department of Health, Education, and Welfare, 1972
- "Gathered at the International Conference on Biological Effects of Carbon Monoxide", Science News, January 24, 1970, pp. 96 - 97
- "Instruction Manual and Programs for Using the Carbon Monoxide Analyzer," The Connecticut Christmas Seal/Lung Association
- 177

Where There is Smoke, There's Rain

Curriculum Topic

METEOROLOGY

Subject

Science, English

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

8

Skills

Reading, evaluating and
communicating information

Site

Classroom

Author

Carla McGeeney

Objective

The students will be able to:

1. discuss several ways in which pollution is affecting our weather, and
2. make conclusions from data about differences between rural and urban weather: does pollution make a change in the weather?

To The Teacher

The article to be read in this activity was first published in 1969 in The Wall Street Journal. In the past nine years, the pollutant level has risen to an extraordinary height. In the same past nine years, laws concerning air pollution have been more strictly enforced.

Before You Begin

Make a copy of the Wall Street Journal article and distribute to each student.

Words To Know

precipitation, meteorology, cirrus cloud, combustion, fossil fuel

ACTIVITY

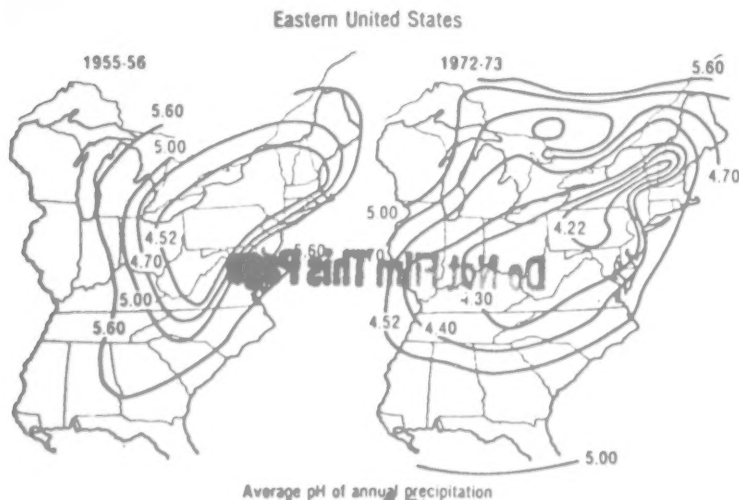
1. Have the students read the article.
 2. Ask students to describe how air pollution has already affected the weather in some places--in their own area, for example.
- Gather rainfall and temperature statistics for the coming week. Compare weather data from the town with data from the nearest city. Is there a difference in rainfall? In daily temperature? What is the major source of pollution in your area? (Is there any industry? Don't forget about cars!)

Credit

Roloff, Joan G. and R. C. Wylder, There Is No "Away"; Glen Coe Press, 1971, pp. 68-72 EEC # B174

Notes To Myself

Precipitation Acidity (pH), Eastern United States, 1955-56 to 1972-73.



Do Not Film This Page

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Do Not

480

Getting the Lead Out

Curriculum Topic

CHEMISTRY

Subject

Science

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

8

Skills

Experimenting, concluding,
measuring

Site

Area near road to take soil
sample, secluded area to take
soil sample, laboratory

Author

Pat Perrella

Objective

Students will be able to:

1. collect soil samples from different areas and analyze for lead content,
2. identify the three sources of lead poisoning.

To The Teacher

The presence of large quantities of metallic atoms in our bodies can have a devastating effect. They interrupt the flow of essential body processes and block biochemical reactions. They are poisonous to our systems. Because lead has such a wide variety of uses (in paint, insecticides, pipes, gasoline) it is a serious threat to human health. A detailed discussion of lead poisoning is included at the end of the activity.

In this lab activity, students will test a specific part of their environment (the soil) for the presence of lead. Lead will show a white precipitate when mixed with sulfuric acid. Lead will show a yellow precipitate when mixed with potassium chromate (K_2CrO_4). The darker yellow, the more lead.

Before You Begin

Materials: balance, medicine dropper, alcohol burner, 3 containers, for soil samples, filter paper, funnel, two 50 ml beakers

Preparation: Prepare 10% solutions of H_2SO_4 (begin with 18 m) and HNO_3 (begin with 16 m). Prepare also a 10% (w/w) solution of K_2CrO_4 in water.

Prior to activity, select locations from which soil samples will be taken. Include areas near a heavily-traveled highway, a less traveled backroad and an area away from traffic.

Caution: Be sure students use safety goggles in the laboratory part of this activity.

The information on lead poisoning can be used in class to initiate class discussion or may be assigned to be read at home.

Words To Know

lead poisoning, filtrate, precipitate

BLOOD LEAD LEVELS OF SELECTED POPULATIONS

Type of Population	Mean Blood Lead $\mu\text{g}/100\text{ ml}$	
	Men	Women
Remote California - Mountain	12	9
Composite Rural United States	16	10
Suburban Philadelphia	13	13
Composite Urban United States	21	16
Los Angeles Aircraft Workers	19	17
Pasadena City Employees	19	12
Downtown Philadelphia	24	18

Adapted from Publication #999-AP02, January, 1965
United States Department of Health

ACTIVITY

1. Take students to the 3 areas you have chosen or soil samples, and have them label the three samples A, B and C.
2. In the laboratory, divide class into groups of two or three students.
3. Have students conduct procedure in student directions. Supervise lab activity.
4. Conduct class discussion and include the following points:
 - a. What is the relationship between the location from which you took the soil sample and the amount of lead? What caused this relationship?
 - b. Would you mind living in a home situated close to a busy highway? Why or why not?
 - c. Where are there likely to be more problems with poisonous lead in the air and in the soil: Near a busy highway or a more secluded road?
 - d. Do you think it is a good idea for the government to put a minimum distance requirement on constructing highways so that they are not too close to people's homes? What problems would this type of law create?

Related Activities

1. Assign a research topic to students: What other metals in the environment might present a hazard to human health? For each metal you examine list:
 - a. the effects on the human body and
 - b. the possible sources from which it might reach the body from the environment.

Resources

"Environmental Education Modules - Bridge to Environmental Responsibility", Project M-E-E, Menomonie Public Schools, 1975, Module No. 76.

Newton, David, Biological Science Casebook, J. Weston Walch, 1974, pp. 64-65.

STUDENT PAGE

GETTING THE LEAD OUT

By following these directions carefully, you can find out which, if any, of your soil samples contain lead.

Method I

1. Measure 10g of sample A. Place it in a 50 ml beaker.
2. Add 30 ml HNO_3 to make a mixture.
3. Heat this mixture gently, stirring slowly, for 5 minutes.
4. Set up a funnel with filter paper. Filter solution. Collect the filtrate (liquid that comes through the filter paper.)
5. Add 5 ml H_2SO_4 to the filtrate with a medicine dropper, one drop at a time; observe if a white precipitate forms. Record on your Data Sheet in Table 1 how many drops until the precipitate formed (if it formed at all). If you do not get a white precipitate there is no lead in your sample.
6. Repeat this process with soil samples B and C.
7. Fill in all information in Table 1 on your Data Sheet.

Method II

Now use another method to detect lead in the same soil samples A, B, and C. Beginning again with sample A repeat steps 1-4 as in Method I of this activity.

5. Add 5 ml K_2CrO_4 to the filtrate with a medicine dropper, one drop at a time. Observe if a yellow color appears. Record on your Data Sheet in Table 2 the number of drops of K_2CrO_4 added before the filtrate turned yellow. Also, describe the shade of yellow (pale, dark). The darker the color, the more lead in your sample.
6. Repeat this second method with soil samples B & C.
7. Fill in all information in Table 2 of your Data Sheet.



"Notice how wildlife naturally adapts to man's progress"

DATA SHEET

Method I

Table 1

Sample	Location	# of drops H_2SO_4 until white precipitate	Check if lead was present
A			
B			
C			

Method II

Table 2

Sample	Location	# of drops K_2CrO_4 until yellow color	shade of yellow	Check if lead was present
A				
B				
C				

Questions

1. Using the H_2SO_4 method, which sample contained the greatest amount of lead (took fewer drops to change)? Why?
2. Using the K_2CrO_4 method, which sample contained the greatest amount of lead? Why?
3. Did you get the same results using both methods? If not, try to offer some possible explanations.

INFORMATION ON LEAD POISONING

If you want to know more about how lead affects you and your environment, here is some information:

Lead is an element that has many uses. But unfortunately, if lead atoms get into our bodies they remain there and act as a poison by blocking important chemical reactions that need to take place in order for our bodies to work properly. But how does lead get into our bodies? In the past lead has been used in making house paint. Many old buildings were painted with lead-based paint. Especially in inner-city areas, these old buildings are deteriorating. The lead-based paint is chipping from the walls and often young children eat these paint chips. The result can be damage to vision, mental retardation and even death. Paint manufacturers have switched from using lead to other non-poisonous materials in making paint.

Another source of lead in our environment is ordinary gasoline. Since the 1950's a compound called tetraethyl lead has been added to gasoline to avoid the problem of "engine knock" in automobiles. But one of the most frightening discoveries made in research on air pollution was how much lead was being released into the atmosphere during the combustion of gasoline in car engines. The lead in gasoline has to go somewhere! It is ending up in the air we breathe and, thus, in our own bodies. Now, non-leaded gasolines have been developed. Some chemists say, however, that burning these compounds in cars will release other toxic chemicals which make up the Los Angeles "smog". The present technique of solving the problem may just be replacing one pollutant with another.

Thermal Pollution

Curriculum Topic

ECOLOGY - BIOLOGY

Subject

Science

Environmental Topic

ENVIRONMENTAL QUALITY - safe waste disposal is important to maintaining the quality of the environment.

Grade Level(s)

4 - 7

Site

Classroom

Skills

Measuring
Reading tables
Observing and recording data
Inferring from data

Author

Maryann Cronin Horgan

Objective

Students will be able to:

1. Use apparatus in a thermal pollution activity.
2. Conclude from data collected that thermal pollution is disturbing and harmful to the environment.

To The Teacher

Thermal pollution describes the harmful impact of heated water on the water source and its biota. Most aquatic organisms have a fairly narrow optimum temperature range for maintaining their physiological comfort. The range at which these organisms can barely survive is somewhat wider (rarely more than about 15 degrees C). Over long periods of time, aquatic organisms can acclimatize themselves to different temperature regimes by shifting their entire range of preferences. But most organisms cannot tolerate rapid or frequent temperature fluctuations, preferring instead a generally stable environment. Many organisms hibernate, estivate or migrate to avoid temperature extremes.

For instance, as water temperature rises, fish initially become more active. However, when the water temperature reaches a certain point, fish enter a state of torpor. In this sluggish state, the fish are unable to feed, even to escape the warm water. Before the thermal death point is reached, the fish die from metabolic causes.

Most thermal pollution can be blamed on electric companies, nuclear power plants, and steam-generating plants. These plants use fresh water as a coolant, then return the water (10-30 degrees warmer than its original temperature) to its source.

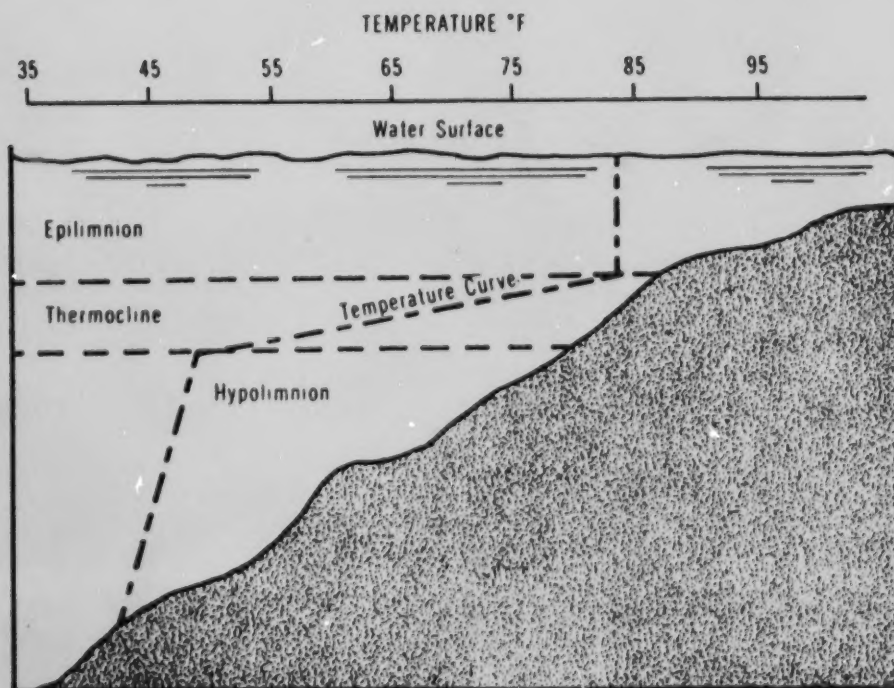
In this activity, students discover the problems inherent in thermal pollution when they add warm water to an aquarium. Even in this mini-ecosystem, an abrupt change in water temperature causes changes in the metabolism of the fish, in the growth of algae and in the water current.

Before You Begin

MATERIALS: aquarium with goldfish or guppies and plants, hot plate, 500ml beaker, dittos of Table 1 and Table 2 for class distribution, beaker tongs, red food coloring, thermometer (degrees C)

Words To Know

thermal pollution, diffusion, ecosystem, thermal death point, current, algae



Typical Thermal Stratification of Reservoirs.

ACTIVITY

1. Students will measure 300ml of water into a 500ml beaker. Add 10 drops of food coloring. Heat water to 80 degrees C.
2. Students will slowly add heated water to the aquarium. Watch the current of warm water as it flows into the cooler, dyed water in the tank.
3. Students will note and discuss all changes - diagram red current, fish movement and plant responses. Make observations for two days. Observations can be made on a rotating basis between class members.
4. Students will examine tables on animal sensitivity to thermal pollution (Table 1 and 2).
5. Teacher can then lead discussion to help students apply their observations to the possible effects of thermal pollution on natural systems (e.g., the Connecticut River in Haddam).
6. Discuss with the class:
 - a) the results of their observations
 - b) the long-term effects of dumping hot waste into a stream or lake
 - c) the main sources of thermal pollution
 - d) methods of stopping thermal pollution
 - e) making better use of the heated water from industrial processes.

Related Activities

1. Draw a food web for a lake or stream in Connecticut. Describe the possible damages to it from thermal pollution.
2. Investigate the effects of thermal pollution on fish reproduction.
3. Write to the Atomic Energy Commission for information on thermal pollution.
4. Visit the Connecticut Yankee Atomic Power Plant in Haddam Neck, Connecticut.
5. Diagram and label a steam generating plant.
6. Test and observe that living organisms use oxygen faster at higher temperatures. (Refer to Environmental Science, the Natural World Modules, Level 3, Silver Burdett Co., N.J., 1977, chapter 5.)

Resources

- Eblan, W., et al., Total Education in the Total Environment, Ch. 7, Pendulum Press, 1971, EEC #B21
- Tark, A., et al., Environmental Science, W.B. Saunders, 1974, pp 198-208, EEC # B78

Credit

- Richnon, J., Life Science, Steck-Vaughn Co., 1976, p. 170-175, EEC #B186

Steve Gold, contributor

Soapy Seeds

Curriculum Topic

POLLUTION

Subject

Science

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

6-8

Site

Classroom

Skills

Collecting and compiling,
interpreting, inferring,
predicting

Author

Carla McGeeney

Objective

The students will be able to:

1. Recognize a seed in germination.
2. Observe and determine the effects of detergent on germinating seeds.
3. Calculate percentages of germinating seeds among those originally planted.

To The Teacher

This activity is an example, in a smaller scale, of what might happen to the seeds a farmer sows if the water used to germinate them contained detergent wastes. Detergents are useful in the home but have a detrimental affect on surface waters. Contaminated water can cause disturbances to all living things.

A seed has germinated if you can see part of a root poking out.

Before You Begin

Materials: Assemble the following for each team of students: 3 plastic petri dishes with lids, 1 paper towel, 30 radish seeds, 10 ml of 1% detergent (liquid dishwashing) solution, 10 ml of 5% detergent solution, wax marking pencil, tape.

Seeds do not need sunlight for germinating, so they can be stacked for storage.

ACTIVITY

Instruct students to:

1. Clean the petri dishes.. Cover the bottom of each completely with a piece of paper towel.
2. Initial petri dish with a wax marking pencil: mark one petri dish C (Control), another 1%, and the third 5%.
3. In the dish marked "C", put 10 ml of tap water. Put 10 ml 1% detergent solution in the dish marked 1% and 10 ml of 5% detergent sloution in the dish marked 5%.
4. Spread 10 radish seeds evenly in each dish.
5. Cover each dish and tape it closed. Store them in a safe place. (Seeds do not need sunlight for germinating, so they can be stacked for storage.)
6. Observe the seeds at the beginning of the next three class periods. Keep the petri dishes covered.
7. When observing the seeds, consider the following questions:
 - a. Can roots, stems and leaves be seen?
 - b. Have the leaves unfolded?
 - c. Are the leaves yellow, white or green?
 - d. Are there any root hairs?
 - e. How many seeds germinated in each petri dish?
 - f. What percent of the seeds germinated?
 - g. Which concentration of detergent had the larger effect on the germination of the seeds?
 - h. What would happen to a farmer's crops if the water used on them had detergent wastes?

Related Activities

Instruct students to:

1. Take the seeds from the "control" dish and plant them in three separate containers. Keep the plants in sunlight as they grow. Water one with tap water, one with 1% detergent solution and one with 5% solution. Identify each by marking with a wax marking pencil. Observe the effect detergent has on growth.

Credit

"Environmental Science," Natural World Module, Silver Burdett Company, 1st edition,

Words To Know

control, germinate

Math in the Environment

Curriculum Topic

MATHEMATICS

Subject

Mathematics

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

6 - 8

Site

Classroom

Skills

Computing

Author

Carla McGeeney

Objective

The student will be able to:

1. Make accurate calculations from data
2. Discover how mathematics applies to environmental problems.

To The Teacher

The following problems can be used for review of material for skill development. The numbers, data and concepts are accurate. Problems are included for the following topics: rational numbers, whole numbers, measurement, per cent and proportion.

Words To Know

combustion, environment, estimate, parts per million (ppm), hydrocarbons, fiscal year, appropriated, expenditure, boron, aerosol-dispensed

ACTIVITY

Instruct students to compute answers for problems on the student pages. Use the problems together or individually, at your discretion.

Related Activities

If time permits at the end of the class period, discuss the environmental issues of each problem. What are some of the implications of the answers to the Problems?

Credit

This activity is based largely on Pollution: Problems, Projects and Mathematical Exercises 6-9; Wisconsin Department of Public Instruction Bulletin No. 1082 EEC #411.

Notes To Myself

Whole Numbers

1. Doctor Richard Wang of Milwaukee reported that his interviews in six months with drug patients in the county hospitals revealed that 37 patients began by using marijuana, 24 used heroin first, 6 began with codeine, 6 began with amphetamines, 5 started on LSD, 3 first used barbiturates, 3 began with morphine, 2 first used cocaine and 1 started by sniffing glue. How many patients did he interview?
2. Wisconsin banned DDT in 1970. However, DDT, once in the food chain, circulates for another 15 years. If this is so, and assuming that there is no other source of DDT contamination, in what year would Wisconsin finally be freed from the effects of this chemical?
3. Erie County in upstate New York is one of the worst air polluted areas in the United States. In a study of the residents of the county it was found that the number of people dying from respiratory diseases is doubling every five years. If in 1960 there were 263 deaths attributed to respiratory diseases about how many would there be in 1965? in 1970? in 1980?
4. A 1965 automobile emits an average of 900 parts per million of hydrocarbons in its exhaust to pollute the air. A 1970 automobile emits a corresponding 180 parts per million. How many 1970 automobiles does it take to pollute the air with hydrocarbons as much as one 1965 automobile?

5.	Land Area (in thousands of sq. km.)	Population (in millions)
Asia and Far East	21,178	1483
Soviet Union	22,403	205
North America	21,483	189
Latin America	20,501	192
Rest of the World	49,770	726

493

Rational Numbers

1. Lake Winnebago covers an area of 168,000 acres, Big Lake Butte des Morts covers 10,000 acres, Lake Poygan covers 10,992 acres and Shawano Lake 6,178 acres.
 - a) Find the total acreage of the four lakes.
 - b) By how many acres does Lake Winnebago exceed Shawano Lake?
 - c) How many times as big is Lake Winnebago than Lake Butte des Morts?
2. During Pittsburgh's years of air pollution a sample of iron exposed to the city's air corroded $2\frac{1}{2}$ times faster than a similar sample at a rural State College. This means that a sheet of iron with a 15-year life-span in the rural State College will have a life span of how many years in Pittsburgh?
3. One gallon of fuel oil consumes 90 pounds of air in the combustion process. If a homeowner uses fuel oil to heat his home and uses $7\frac{1}{2}$ gallons per day, how many pounds of air will be used in heating his home 30 days?
4. The Aswan Dam project built on the Upper Nile River stopped the flow of nutrient-rich silt from reaching the Mediterranean Sea. Without this silt the Egyptian sardine catch declined from 18,000 tons in 1965 to 500 tons in 1968. What fractional part of the 1965 catch was reaped in 1968?
5. In 1970 it was estimated that about $\frac{2}{3}$ of the people of the world go to bed hungry. There are in the world approximately $3\frac{1}{2}$ billion people. At that rate approximately how many people go to bed hungry?
6. There are about $2\frac{1}{4}$ Americans for each vehicle that is in use. If there were 203 million Americans in 1970, about how many vehicles were being used?
7. Approximately 90 million vehicles are used by Americans. If each year $\frac{2}{25}$ of these vehicles are junked, how many vehicles do we need to dispose of each year.

Per cent and Proportion

1. At one time more than 6000 commercial ships arrived annually at the Milwaukee harbor. In 1964 federal statistics show that approximately 3,900 commercial ships entered and left the harbor. Compute the per cent of decrease.
2. When Wisconsin became the thirtieth state in the union in 1848, its population was 210,546. By 1950 the population of Wisconsin was 3,434,575.
 - a) Find the increase in population to the nearest 100,000.
 - b) Using rounded figures, find the per cent of increase.
 - c) Find the per cent of population in 1848 compared to the population in 1950.
3. The United States produced about 53 million tons of paper and paperboard every year. In 1969 we recycled only about 22% of the paper and paperboard we produced. How many tons of paper and paperboard were recycled?
4. 8,000,000,000 acres of the world are suitable for crops. Only $43 \frac{3}{4}\%$ of this land was cultivated in 1969. If there existed in 1969 approximately an acre of cultivated land for every person, what was the population of the earth?
5. Americans generate approximately 500 tons of garbage per year, Danes only 150 tons. What per cent of the total garbage produced by Americans and Danes is produced by Danes?
6. Seven Southeastern Wisconsin counties, Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha have a total area of 2,689 square miles. This land area represents 5% of the total area of the State of Wisconsin. How many square miles are in the State of Wisconsin?
7. The average person uses 20 gallons of water per day for showers. 37% of the total household water per person per day is used for showers. What is the average amount of water used per person per day in an average household?

Measurement

1. According to an estimate, on July 1, 1969 the population of the United States was 201,921,000 persons.
 - a) Rounded to the nearest million, what would the population be?
 - b) Rounded to the nearest hundred thousand, what would it be?
2. If the population of the United States in 1960 was 178,464,000, what was the population in 1960 to the nearest million? To the nearest hundred thousand? To the nearest billion? To the nearest hundred million?
3. From one square mile of land which is subdivided for homes, 140 acres must be used for roads and open spaces such as parks or recreational areas. How many acres are remaining for home construction? If we subdivide this area into three lots per acre, how many homes can be built on one square mile?
4. Open pit mining destroys approximately 153,000 acres of land each year. How many square miles would this occupy?
5. The interstate highway system uses up about 50 acres of land per mile.
 - a) At this rate, how many acres of Wisconsin land was used for the interstate highway system from Beloit, Wisconsin to St. Paul, Minnesota, a distance of 304 miles?
 - b) How many square miles of land does this represent?
6. Los Angeles has a potential of more than 20,000 tons of air pollution per day.
 - a) If the area of Los Angeles is about 1400 square miles, what is the potential pollution output per square mile per day?
 - b) If 1 mile = 12 city blocks, what is the pollution output ~~per~~ square city block per day.
 - c) How many pounds does this equal?

Antibiotic Tag

Curriculum Topic

DRUGS AND NUTRITION

Subject

Science

Environmental Topic

ENVIRONMENTAL QUALITY

Grade Level(s)

7-8

Site

Outdoors

Skills

Group skills, inferring
from data

Author

Steve Gold

Objective

The student will be able to:

1. recognize by inference that drug-resistant bacteria make curing infectious diseases more difficult.

To The Teacher

The accidental discovery of penicillin by Alexander Fleming in 1928 brought the world its first modern antibiotic. Since then, a constantly accelerating pace of research has brought the world over eighty of these chemicals, which kill or inhibit growth of bacteria. Antibiotics have been vital in curbing dangerous infectious diseases, including pneumonia, cholera, typhoid fever, and bacterial dysentery.

Antibiotics are widely used worldwide today. Unfortunately, they are not always used wisely. In developed countries, antibiotics are often prescribed as mere placebos for conditions which the drugs have no effect on. They are routinely used for prophylactic purposes in hospitals. They are added to cattle feed to enhance growth as well as to prevent infection. Eight billion doses were certified for use in the United States alone in 1972. In less-developed countries, the situation is worse. There, the antibiotic drugs are sold over-the-counter and used as cure-alls by the citizenry as casually as Americans use aspirin.

Antibiotic overuse has led to a microbial environment in which these chemicals are endemic. In hospitals, for example, antibiotics may be found in small quantities in the very air. The high environmental levels of antibiotics have dramatic effects on the ecology of bacteria. In much the same manner as pesticides foster the development of resistance in insects, antibiotics set up strong selective pressures for drug resistance in bacteria. Since bacteria have such short generation times, they evolve this resistance with remarkable rapidity.

The mechanism works this way. In any bacterial population, a few individuals on the order of perhaps one in a million -- will be mutants with genetic materials that alters their chemistry and makes them immune to the effects of a particular drug. If the drug is used, nearly all the bacteria will die or fail to reproduce. The resistant ones, which are unaffected by the antibiotic, therefore make up an even larger fraction of the next generation. In a number of generations, unless the drug is withdrawn, nearly the entire population would be resistant. In today's antibiotic-filled environment, the pressure of natural selection on bacteria is constant.

Unlike the insects, the bacteria have added a new twist: transferability. The genetic factors, called R-factors, which carry drug resistance are found on tiny cellular structures called plasmids. These plasmids may be transferred from bacterium to bacterium. It doesn't matter if the bacterium is already resistant to another drug, or whether it is harmless or infection-causing (pathogenic). The result is that bacteria can rapidly become resistant to a variety of antibiotics. Many of the beneficial bacteria normally found in the human intestine are already multi-resistant, and they can easily transfer this resistance to dangerous enteric (intestinal) organisms. Shigella strains, for example, some of which may cause typhoid or dysentery, were 95% resistant to ampicillin in a study conducted in Washington, D.C.

Spreading drug resistance has already led to severe public health problems. Epidemics in developing countries may kill thousands while doctors struggle to find a drug that will be effective. In 1968-69, over 12,000 Guatemalans died when an epidemic of dysentery broke out which was resistant to four types of antibiotics. In 1972, typhoid fever caused by germs resistant to four antibiotics, including the "drug of choice", chloramphenicol, affected a minimum of six thousand persons in Mexico. Bacteria which become resistant in cattle have led to salmonella outbreaks in the U.S. and Europe. And in hospitals, resistance causes treatment difficulties and an increased death rate in bacillemia and bacteremia, infections which kill approximately one hundred thousand Americans annually.

This activity demonstrates the difficulties caused by drug resistance by having kids play tag. "Killing" the "bacteria" becomes more and more difficult for the "antibiotics" as resistance becomes more widespread.

Before You Begin

Select the area in which you will play the game.

Materials: watch with second hand, antibiotic markers in two (2) colors, crayons or magic markers, bacteria markers in two (2) colors

Antibiotic markers must be conspicuous. They could be round cardboard, hung around necks or wrists with string, or colored headbands. Bacteria markers must be easily concealed. Possibilities include index cards that each student can carry, with a large "R" on one side of some to indicate resistance; or make a necklace of the cards with the "R's" facing toward the student. Be certain that the antibiotic and bacteria markers are unmistakably distinct.

Words To Know

resistance, bacteria, typhoid, antibiotic, transferable, sensitive



Conservation News

ACTIVITY

1. Introduce the idea of antibiotic resistance to the class. Then explain that they are going to explore the effects of antibiotic resistance by playing a game of tag to simulate what goes on in the human body.
2. Take the class to the site. Set boundaries and any basic ground rules.
3. Explain the rules for Round One:
 - a. About $1/4$ of the class will be antibiotics. Depending on the size of the group, divide the antibiotics into two color classes (representing different drugs). Distribute their markers. For a class of 28, 7 students will be antibiotics (4 blue and 3 red).
 - b. The rest of the class will be bacteria. None will be drug-resistant. If tagged by any of the antibiotics, the bacterium is "killed" and leaves the field.
 - c. Allow the bacteria to disperse over the playing area. Then release the antibiotics from one point.
 - d. Give the antibiotics three to five minutes to try to capture bacteria. Two thirds of the bacteria must be captured to cure the disease.
4. After Round One is played, explain the rules for Round Two.
 - a. Select antibiotics as before.
 - b. Give the bacteria their markers -- one for each color antibiotic being used per student. About $1/4$ should be given "R" markers for each antibiotic, with about one-tenth of the bacteria resistant to two or more antibiotics. In bacterial population of 21, five should be give "blue R's" five should be given "red R's," and two should be given both blue and red R's.
 - c. If a bacterium is tagged by antibiotic which it is immune to, it shows the "R" marker of that color to the tagging antibiotic, which simply must chase an other bacteria. This bacteria lives.
 - d. Dispersal, pursuit, and "cure" are as before.
5. After Round Two has been played, explain the rules for Round Three.
 - a. Select antibiotics and bacteria as in Round Two.
 - b. Explain that now, all the bacteria that are resistant may also transfer their resistance, without losing their own. Give each bacterium a crayon or magic marker. At any time during the game, a non-resistant and resistant bacterium may clasp each other's hands. They then kneel while the resistant bacterium uses his crayon to write an "R" on the sensitive bacterium's marker, rendering the formerly sensitive bacterium resistant. Resistance may be transferred only for drugs which one of the bacteria is already immune to. Resistance to more than one drug may be passed at a time. Each bacterium in a pair may donate R-factors to the other. After transfer, the pair splits up. During transfer, each member of the pair may be tagged and "killed" by an antibiotic until the "R"

is actually written.

- c. Play the game as in Round Two.
6. After the game, discuss the implication with your students:
 - a. When was it easiest for the antibiotics to cure the disease?
 - b. When was it hardest?
 - c. If real bacteria were to become resistant to nearly all antibiotics, what might the results be?
 - d. How could we prevent this? (The introduction should be sufficient to have the student infer that curtailing the use of the most common antibiotics should ease the resistance problem.)
7. If you have time, allow students to make variations of the game. For example: increase the number of types of antibiotics; increase or decrease the numbers of resistant bacteria; change the relative numbers of bacteria and antibiotics; play a round in two parts -- first have only antibiotics which most bacteria are resistant to, then introduce a wonder drug, which the bacteria are almost entirely sensitive to, half-way through. Etc.

Related Activities

1. Have the kids graph the number of bacteria remaining alive at the end of each round against the number of the round.
2. Discuss the parallel situation of resistance in insect pests.
3. Have the children ask their doctors whether the doctors think antibiotics are overused, underused, or used about the right amount, in this country and in less-developed countries. Pool the results into survey findings for the medical community in your town.

Resources

- Anderson, E. S., Journal of Hygiene, April 1975, pp. 289-297.
- Crossland, J., "Power to Resist", Environment, March 1975, pp. 7-12.
- Simmons, H. E., and D. Stolley, Journal of the American Medical Association, March 4, 1974, pp. 1023-1026.

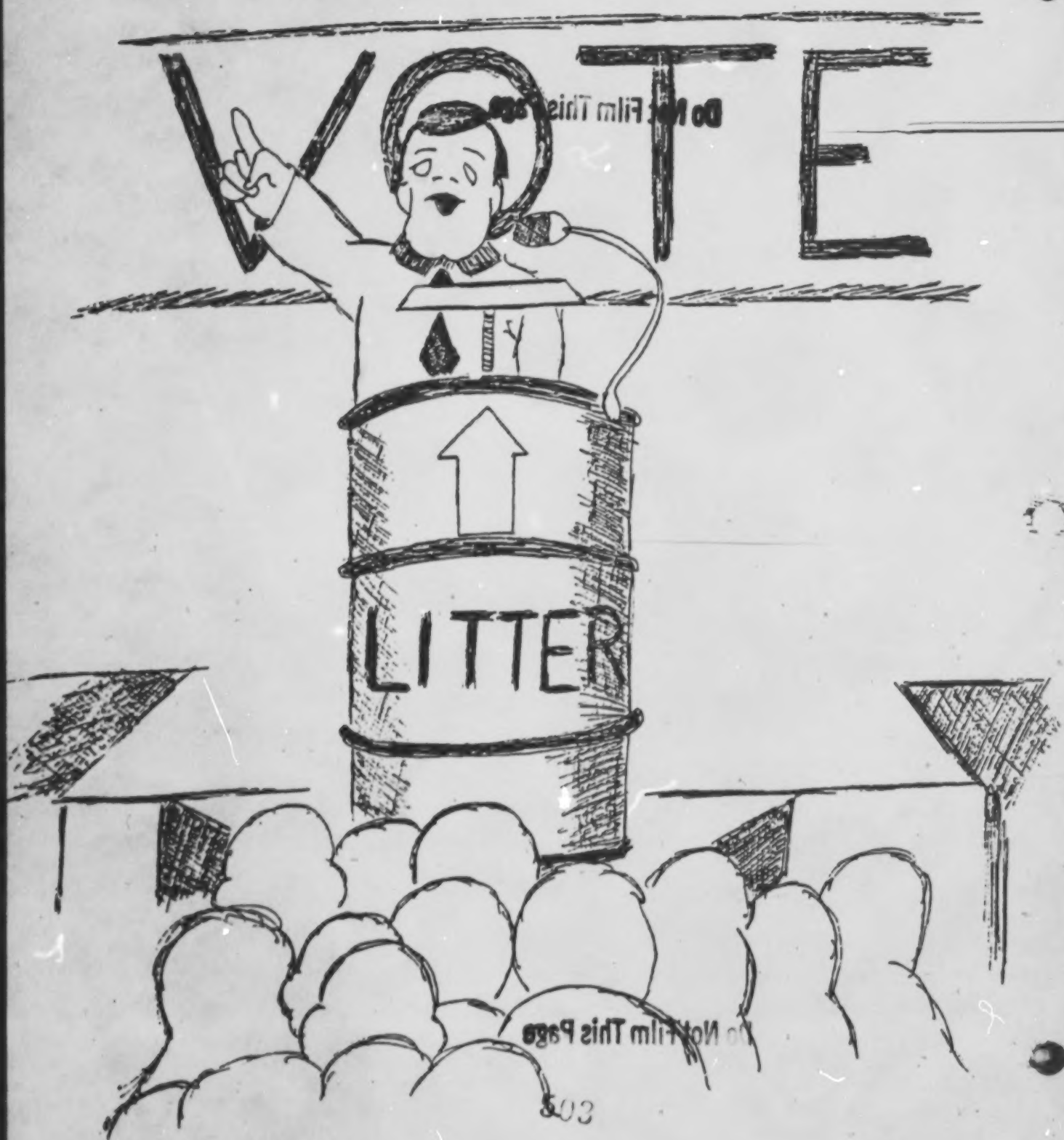
Credit

The idea for a tag game comes from "Food Chain Game", OBIS Trial Edition Set II, Lawrence Hall of Science, University of California at Berkeley, 1975.

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ENVIRONMENTAL POLICY



ENVIRONMENTAL POLICY

<u>ACTIVITY TITLE</u>	<u>PAGE NUMBER</u>
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ENVIRONMENTAL POLICY

The singular most important segment of environmental learning is in the area of environmental policy. This area brings together, in an action phase, all six of the other concept areas. The environmental policy phase relies on factual information assimilated in the other areas for the active process of making an effective environmental decision and implementing it.

In the Environmental Education Activities Manual, William B. Stapp and Dorothy A. Cox comment on the need for the study of environmental policy.

"In many education systems, it is assumed that students who have been through science and social studies investigation somehow know and can utilize skills in problem solving. When such skills are taught in academic isolation, students are left to synthesize the skills into a personally useful process, if they can. Since the environmental education model is based on student involvement, problem solving skills are essential to developing and carrying out action plans." p. 11

Stapp and Cox continue by defining the steps in what they have called community problem solving. Similarly, many policy scientists have identified generalized steps in the policy process for any field. One distinguished policy scientist, Garry Brewer of Yale University, divided the policy process into five phases. The table below compares Stapp and Cox's community problem solving with Brewer's phases of the policy process.

Community Problem Solving Stapp and Cox	Policy Process Brewer
1. Define problem or issue	A. Initiation
2. Become informed	i. recognition of problem
3. Identify alternate solutions	ii. identification of problem
	iii. determination of goals and objectives
	iv. generation of alternatives
4. Evaluate alternate solution	B. Selection
5. Develop a plan of action	
6. Implement the plan of action	C. Implementation
7. Evaluate the implementation	D. Evaluation
	E. Termination

It is clear that environmental education community problem solving is clearly related to the generalized policy process.

The policy process relies on factual information assimilated in other areas, a set of values and/or ethics for the active process of making and implementing an environmental decision.

One learns the problem solving process and puts it to a test in a real and simulated decision-making situations. This process integrates content, trade-offs and values into a holistic view.

High School Energy/Environmental Education Training Model: Content Sourcebook prepared by Far West Laboratory for Educational Research and Development, 1978 (Draft version)

Land at the Crossroads

Curriculum Topic

CIVICS, CITIZENSHIP, URBAN STUDIES - Man's use of land sometimes come in conflict with nature's intended use of it.

Environmental Topic

ENVIRONMENTAL POLICY: Environmental decisions should be made only after considering all alternatives and the consequences of each.

Skills

Problem solving
Valuing, identifying alternatives
Group interaction

Subject

Social Studies

Grade Level(s)

4 - 8

Site

Classroom

Author

Paul Sanderson

Objective

The student will be able to:

1. Analyze in discussion and debate, a problem situation which presents strongly opposing solutions by discussing and debating the issue.
2. Work in a group to reach a group decision.

To The Teacher

The use of land in your local community may arouse conflicting points of view. Each individual or interest group has an opinion which may differ dramatically from that of their neighbors. This can be the case when our use of land comes into conflict with nature's intention. In recent years environmental groups have come to the defense of "nature", and have prevented the building of dams and highways that would otherwise have destroyed unique habitats or rare species of plant and animal life. Other interest groups express the sentiment that the natural environment must be compromised, (at least), in order to maintain healthy economic and social development in our society. These are not clearly-defined issues, but they are ones that we all must deal with in our responsibility to local and state government and to our natural environment.

Before You Begin

MATERIALS: overhead projector, screen, paper and pencils, transparencies

ACTIVITY

1. Divide the students into groups of six to eight students.
2. Describe the following, hypothetical situation:
A new high school is to be built. Many of you will attend it. (Show transparency of high school location). It will be very modern: classrooms, labs, shops, cafeteria, gymnasium, pool, student activity room, playfields and park-like grounds. It will replace an old, ill-equipped, over-crowded high school. The site for the new school is well located in your town. It is, however, also the habitat of the Southern Bog Lemming (show transparency), an animal which requires a habitat of a very special nature: wet meadows, swamps and bogs. It is a secretive animal, rarely seen, and considered rare in the area. The architects' drawings indicate that the location of the new school is the present home of the lemmings. (Overlay lemming habitat transparency on high school transparency).
3. Each student is assigned, or chooses to represent an interest group, an individual concerned about the dilemma, or the lemmings themselves. Roles that could be used are: The bog lemmings, high school students, architects, superintendent of schools, teachers, the wet meadow, an environmentalist, naturalist, mayor, construction worker, planning board member.
4. As homework, ask the students to research their roles, giving thought to how the real subject their role represents would feel about the issue at hand.
5. During the next class period, review the issues, and ask each person within the small groups to "speak" for the role he/she is portraying.
6. When everyone in the group has spoken to express their feelings and concerns, open a question and answer period, during which some representatives will lobby their causes. Limit debate to 10 minutes, after which a vote by majority-rule is held. Yes = school is to be built; No = school should not be built.
7. Later, discuss:
 - a) How some issues are not clear-cut, and decisions about them are not easily made.
 - b) How did it feel to represent, in your "role", an interest you may not have agreed with personally.
 - c) Are all community decisions agreeable to all members of that community?
 - d) Is majority rule always the rule?
 - e) How can you influence people to see your point of view?
 - f) What ecological considerations are taken into account in your community and/or state before the land is changed?

Words To Know

habitat, role, zoning, Bog Lemming, majority, conflict, issue, influence, interest group, lobby

Credit

Drawing: Cecelia Zych

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Related Activities

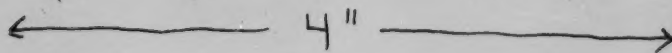
1. Ask students to offer alternative solutions to the conflict by brainstorming for 5 minutes.
2. Ask students to indicate their own positions within a continuum, represented on the blackboard in the following manner:

save lemming habitat

build high school

Notes To Myself

SOUTHERN BOG LEMMING



LIVES IN WET MEADOWS AND BOGS

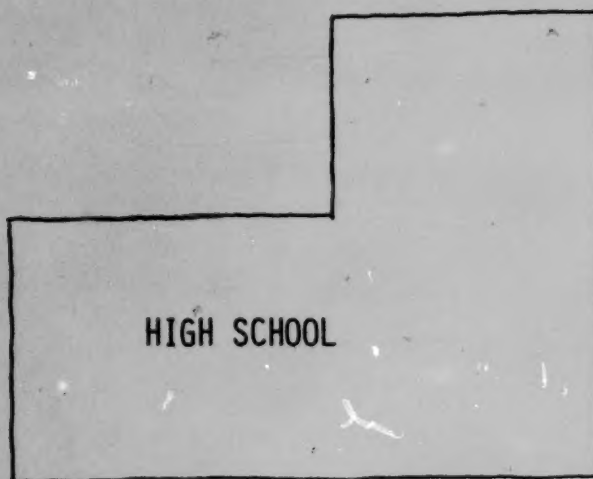
VERY SECRETIVE

RARE SPECIES

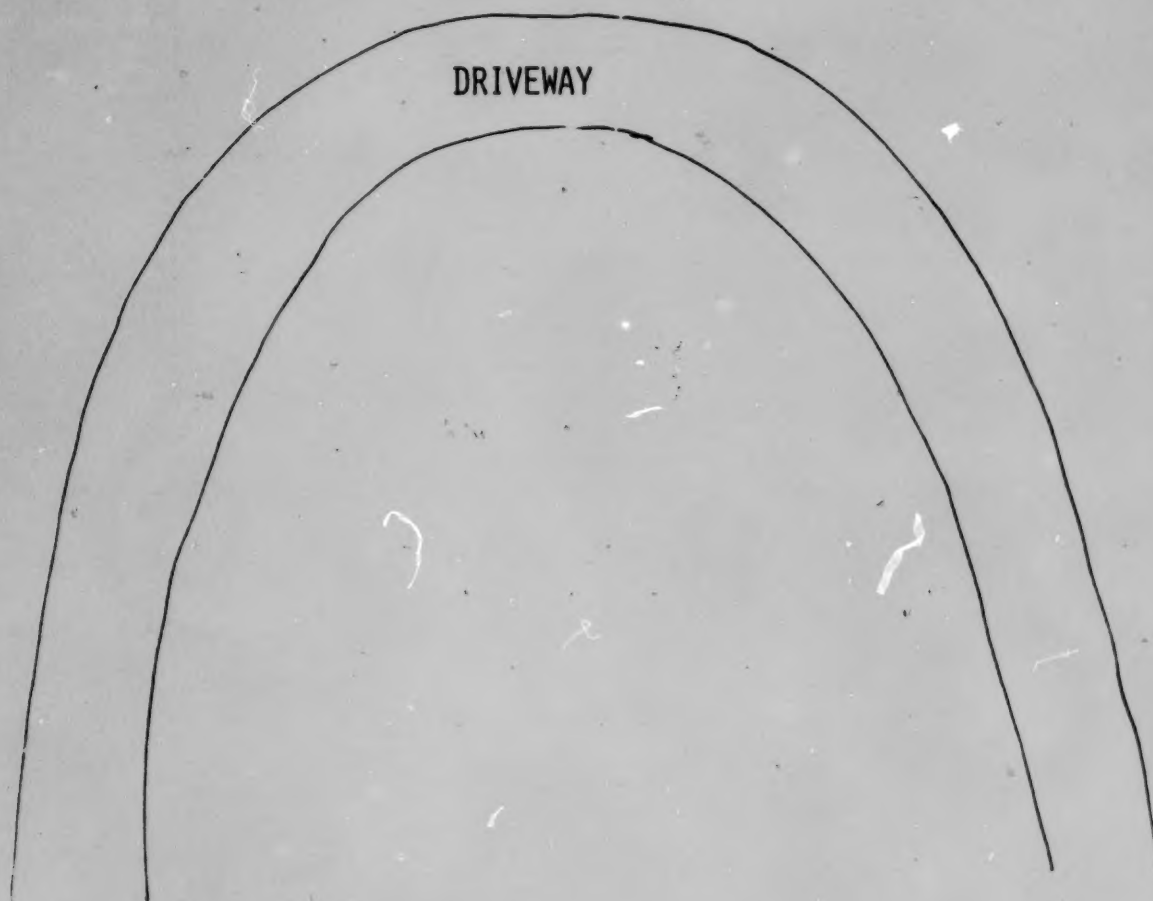
NEEDS SPECIAL HABITAT

EATS GRASSES

511

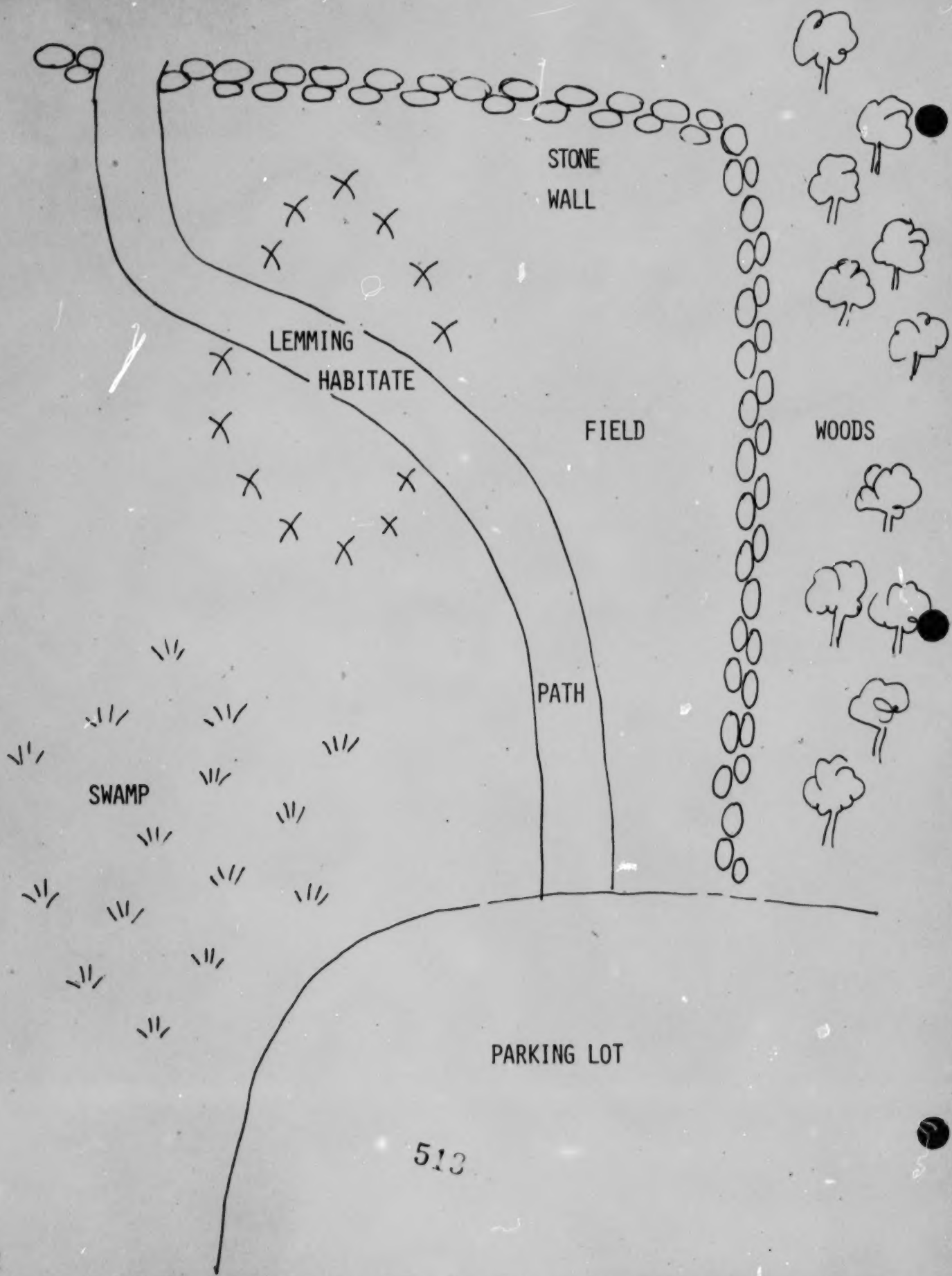


HIGH SCHOOL



DRIVEWAY

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Supply and Demand; Shortage and Surplus

Curriculum Topic

ECONOMICS

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL POLICY

Grade Level(s)

6-8

Site

Classroom

Skills

Identifying consequences of alternatives, interpreting data, reading, locating and obtaining information

Author

Ed Lisk*

Objective

Students will be able to:

1. describe the impact of shifting supplies on the price of energy
2. illustrate the concept of supply and demand, using energy as the sample commodity.

To The Teacher

Supply, demand, shortage and surplus are concepts within the study of economics. In this activity, we will examine them simply and superficially as they relate to the continually fluctuating price of oil. Energy price changes in the world market are not simple to understand. Many complex factors have dictated the economics of energy in the past half-decade. In the U.S., the most significant example of these is our growing dependence on imported energy, the availability and price of which are controlled by the Organization of Petroleum Exporting Countries (OPEC).

On October 17, 1973, most of the oil-producing countries of the Mideast placed an embargo on oil shipments. Although the embargo lasted just five months, the industrialized nations of the world are still experiencing the economic and social disruption caused by this interruption in our assumptions about the availability of oil. Prices of all commodities rose, contributing to worldwide inflation. Unemployment, at the same time, increased. In fields relating to work in energy, unemployment rose particularly. We have been forced to take a hard look at the future as regards energy sources for the world. The price of energy will have a significant impact on the environmental choices available to us and other countries in the future.

Before You Begin

Make copies of Student Page

Words To Know

supply-demand, shortage-surplus



"Didja know that the Chinese began drilling for oil in the third century B.C., using bamboo tubes and bronze bits?"

*Cartoon from Energy Insider, U.S. Department of Energy, July, 1978, p.7

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ACTIVITY

1. Ask the students to discuss shortages and price increases they have experienced recently. Example: movies, candy, concert tickets, gasoline, food, etc.
2. Hand out student worksheets for students to complete. Answers to student worksheet (listed in order of appearance in story: 4, 4, 11, 5, 12, 10, 1, 9, 2, 9, 7, 12, 5, 6, 3, 8)
3. Discussion Questions:
 - a. How are prices of many products affected by an energy shortage?
 - b. How would you be affected if your parents could not drive? What would happen in the lifestyle of your family if they were required to cut back on their supplies of gasoline by 30 percent?
 - c. What would you do if you had 100 tickets to a rock concert but your friends had none?

Related Activities

1. Tour a local small factory or business that deals with a product. Ask the owners how shortages and surpluses have affected their industry.

Resources

Spadaro, Louis M., Economics: An Introductory View; Benziger, 1975.

Credit

*This is largely excerpted from "The Energy Challenge", U. S. Department of Energy, Worksheet Activity #23, 1976, EEC #1012.

Notes To Myself

Supply and Demand; Shortage and Surplus

STUDENT PAGE

Finish the story by filling in the blanks. Think of the right answer. Then see if it appears in the answers below. Put its number in the blank. Some answers may be used more than once.

POSSIBLE ANSWERS

- | | |
|----------------|-----------------|
| 1. 40 | 7. shortage |
| 2. lowered | 8. raised |
| 3. supply | 9. surplus |
| 4. 200 gallons | 10. 160 gallons |
| 5. \$3.00 | 11. demand |
| 6. 5 gallons | 12. \$60.00 |



Mr. Smith, a gasoline station owner, received 200 gallons of gasoline regularly each week. His 20 regular Smalltown customers were used to buying all the gas they needed. Although some weeks some people bought more and some bought less, average use was 10 gallons a week. The total demand

for gasoline each week, then, was _____. As you have seen, Mr. Smith's supply was _____. Everybody was pretty happy about the whole thing. The supply was equal to the _____.



Mr. Smith charged 30¢ a gallon for gasoline, a price that was about the same as that charged by the other station in town. Each regular customer spent an average of _____

_____ each week. Mr. Smith received _____ for

gasoline. When the other station reduced its price per gallon by a penny, four of Mr. Smith's regular customers deserted him and went across the street. He was still getting a delivery of 200 gallons a week, but now the demand was only _____.

He had _____ gallons left over. This unbought quantity of gasoline is called a _____.

To get rid of the surplus, Mr. Smith _____ his price. His other regular customers bought up the _____ and took a few more pleasure trips into the city.



Several weeks later, Mr. Smith and the other station each received only 100 gallons of gasoline. Their suppliers were short of gasoline that week. Their customers' demands were still the same, so the pumps soon became empty.

"No More Gas!" the sign in front said. Halfway through the week, Mr. Smith had a _____ of gasoline. By still charging 30¢ a gallon, he didn't make enough to pay the costs of his station.



The next week he raised the price to 60¢ a gallon. Even at the higher price, most of his customers still had to buy gas to drive to work and do errands, so he sold all 100 gallons.

How much money did he receive? _____

_____ What was the average amount each of the 20 regular customers spent?

_____ What was the average amount of gas each customer used? _____



Some of Mr. Smith's customers were on a fixed budget and couldn't afford to spend more than \$3 a week for gas. Some customers got to the station after the pumps were empty and couldn't get all they needed. Some of the other station's customers came over to Mr. Smith's station. The demand was greater than the _____. Mr. Smith _____ his gasoline prices again.

Discuss in your class ways in which the people of Smalltown might solve their gasoline supply problem.

The Offshore Oil Dispute

Curriculum Topic

FOREIGN RELATIONS
Cooperation is tantamount to food for survival.

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL POLICY
In order to survive as a world, we must, as separate nations, share resources and cooperate.

Grade Level(s)

6-8

Site

Classroom (Simulation Game)

Skills

Following directions, interpreting data

Author

Thomas J. Kotulski

Objective

Students will be able to:

1. infer that cooperation is more productive than conflict.

To The Teacher

This activity is designed to illustrate that by cooperating, otherwise opposing parties avoid conflict and reap benefits.

ACTIVITY

1. Divide the class into groups of three; two students will play the game while the third acts as referee.
2. Give each of these small groups the attached scenario and game description to read (See Student Page).
3. Lead a discussion: Indicate the highest score (most money "won" by a pair of players in one game) on the blackboard. Next to that score indicate the number of cooperative efforts, wars and property seizures which took place. Then list the lowest score. Beside it, indicate similar information:
 - a. Which is more successful: cooperation or conflict?
 - b. Did any group establish cooperation (trust) without communication?
 - c. Did effort to seize the islands increase cooperation?
 - d. How should countries solve international conflicts? Why?

Related Activities

1. Play "Lost on the Moon" according to the following directions:
 You are in a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Mechanical difficulties however, have forced your ship to crash-land at a spot some 200 miles from the rendezvous point. The rough landing damages much of the equipment aboard. Since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200 mile trip. Below are listed the 15 items left intact after landing. Your task is to rank them in terms of their importance to your crew in its attempt to reach the rendezvous point. Place number 1 by the most important item, number 2 by the second most important and so on through number 15, the least important.

_____ Box of matches	_____ Stellar-map (of the moon's constellation)
_____ Food concentrate	_____ Life raft
_____ 50 feet of nylon rope	_____ Magnetic compass
_____ Parachute silk	_____ 5 Gallons of water
_____ Portable heating unit	_____ Signal Flares
_____ Two .45 calibre pistols	_____ First aid kit containing injection needles
_____ One case dehydrated milk	_____ Solar-powered FM receiver transmitter
_____ Two 100-pound tanks of oxygen	

Listed below are the correct rankings for the "Lost on the Moon" items, along with the reasons for the rankings provided by the NASA's space survival unit.

- (15) Box of matches
- (4) Food concentrate
- (6) 50 feet of nylon rope
- (8) Parachute silk
- (13) Portable heating unit
- (11) Two .45 calibre pistols
- (12) One case dehydrated milk
- (1) Two 100-pound tanks of oxygen
- (3) Stellar map of the moon's constellation
- (9) Life raft
- (14) Magnetic compass
- (2) 5 gallons of water
- (10) Signal flares
- (7) First-aid kit containing injection needles
- (5) solar-powered FM receiver transmitter

Little or no use on the moon

Supply daily food required

Useful in tying injured, help in climbing

Shelter against sun's rays

Useful only if party landed on dark side

Self-propulsion devices could be made from them

Food, mixed with water for drinking

Fills respiration requirement

One of the principal means of finding directions

CO bottles for selfpropulsion across chasm, etc.

Probably no magnetized poles; thus useless

Replenished loss by sweating, etc.

Distress call within line of sight

Oral pills or injection medicine valuable

Distress signal transmitter, possible communication with mother ship

Credit

This activity is based on Prisoners Dilemma, Teaching Youth About Conflict and War; National Council for Social Studies, 1973.

"Lost on the Moon" was originally devised by Jay Hall, Ph.D., American Behavioral Science Training Laboratories, Houston, TX.

Notes To Myself

STUDENT PAGE

The year is 1985. Vast oil deposits have been discovered in the Bering Straits between USA and Russia. Before this time, neither country has pressed its claim to the area although both have strong historical and legal attachments. The shortage of oil for the world had now led each of these countries to desire and actively seek possession of this territory, although the future development of both countries depends upon this newly-discovered oil.

In the game you are about to play, one of you will represent the USA, and the other, Russia. (You can flip a coin to decide who will represent which.) The third player will be referee and scorekeeper. Players have 2 action choices: 1) to cooperate in obtaining oil from newly-discovered source and to share the profits; 2) to attempt to seize the territory where this oil has been found. There will be 10 rounds of action; each round representing a different island of the area.

Choices will be indicated in the following manner: Each player holds a hand under the table. The referee will say "1-2-3, show!" At that command, players will show, at the same time, 1 finger or 2. One finger means "cooperate", 2 fingers means "seize the island." If both countries show 1 finger, indicating cooperation, each receives \$1/2 billion. If one country indicates seizure and the other cooperation, the island is seized. The seizing nation receives \$2 billion while the one taken loses \$1 billion. If both show 2 fingers (a war) both lose \$1 billion, (cost of naval and amphibious operations). The referee keeps note of the situation and the resulting monetary changes for each of the 10 rounds. Now go to it...!

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"Poaching"

Curriculum Topic

AFRICA, CHINA, ARGENTINA
GEOGRAPHY

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL POLICY

Grade Level(s)

5-8

Site

Classroom

Skills

Gathering information,
constructing hypothesis
brainstorming

Author

Cyndi Walsh

Objective

The student will be able to:

1. identify some endangered species in Africa, China and Argentina,
2. analyze factors which affect the interrelatedness of life.

To The Teacher

The following activities serve to reinforce the concept of the interrelatedness of life. It examines food webs disturbed - or destroyed by the demands of world export and import markets. All too often hunting for trade results in endangered species.

Usually the full impact of this hunting of particular species can not be readily observed until it is too late. But many incidents of species removal and the ramifications have been cited.

The first food web, Chart 1, deals with such case histories.

CHART 1

<u>ANIMAL</u>	<u>REASON FOR DECLINE</u>	<u>IMPACT ON ENVIRONMENT</u>
Hippopotamus	Central Africans killed many because crops were trampled by the hippo.	Realized too late that the droppings of hippo fertilized water which contributed to algae growth that fed the main fish product, the "Tipara" - many people went hungry.
Alligators	Argentinians hunted the alligator for its valuable skin.	With the predator of the pirahna (alligator) gone, pirahna populations boomed attacking livestock that watered in rivers. Many times the oldest animal was sacrificed to pirahna so others could cross waterways.
Crocodiles	Madagascar people hunted the crocodile for its valuable skin.	With the predator of the wild dogs (crocodile) gone, populations boomed - dogs carried rabies and bit many people who died of the disease. Also there were increased snake hazards and wild pigs destroyed farmlands.
Jungle cats and owls	Argentinians destroyed many of these animals.	Predator gone - disease carrying rats multiplied and infected the people.

The second part, Chart 2, deals with the "unknown" consequences of species removal. Today we do not know the impact of the loss of these species.

CHART 2

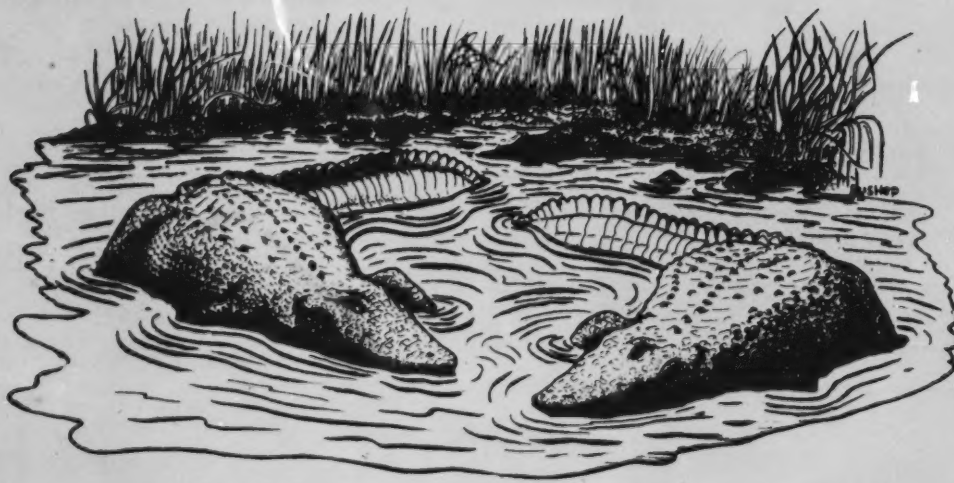
<u>ANIMAL</u>	<u>COUNTRY</u>	<u>REASON FOR DECLINE</u>
Chimpanzee	Africa	Hunted for trophies and sport
Cheetah	Africa	Hunted in South Africa and Southwest Africa
Black Rhinoceros	Africa	The horn has been hunted illegally
Siberian Tiger	China/ Siberia	Hunted for its bones, flesh blood (medicinal purposes)
Wild Bactrian Camel	China	Overhunted for food and skin

Before You Begin

Materials: paper and pencil, duplicated Student Pages, animal resource books

Words To Know

extinct, endangered, poaching, predator



Cartoon by Jack Shepherd/NWF Art Department

**"I NEVER CAN REMEMBER.
WHAT ARE WE ANYWAY -
ALLIGATORS OR CROCODILES?"**

Conservation News 10-15-73

ACTIVITY

1. Read Student Information sheet aloud. Discuss to set the stage for the brainstorming session to follow.
2. Hand out page 1 of Student Worksheet.
3. For each of food chains on the Student Worksheet, ask students to hypothesize the impact of the removal of the:
 - a. jungle cats,
 - b. crocodile,
 - c. alligator and
 - d. hippo

from the ecosystem.

4. After discussion, from the To The Teacher Chart 1, explain to students the actual impact which the species removal had on the local environment.
5. Discuss why it is usually impossible to know the full impact of species removal beforehand.
6. Divide class into groups for part 2 of the activity.
7. Give each group an animal population that is declining as listed on Chart 2 (from To The Teacher). Using a combination of research and brainstorming, ask the group to create a food chain or web for each species listed. After food webs are created, ask each group to hypothesize the impact of the loss of the endangered species.

Related Activities

1. Write to the Chamber of Commerce of the United States and other countries to determine their import-export system.
2. Find out about animals legally hunted and/or exported from the United States (ex. big horn sheep).
3. Compile a list of safe imports that do not impact an endangered species.
4. Make a list of safe and unsafe souvenirs (i.e. Safe souvenirs do not harm the ecosystem when removed. For example, pictures or a diary of a trip as opposed to buying a stuffed toy animal made with real koala fur; taking a "living" thing from its environment as opposed to a seashell collection.)

Resources

"Wildlife in Danger", Newsweek, January 6, 1975, p. 36-40.

Oswald, J., Planet Earth, Houghton Mifflin Social Studies Program, 1976, p. 247.

STUDENT PAGE

STUDENT INFORMATION SHEET

HUNTING AND ILLEGAL POACHING OF WILDLIFE FOR SPORT AND TRADE CONTINUES DESPITE STRICT CONSERVATION LAWS. IN INDONESIA, THE NEAR EXTINCT SUMATRIAN TIGERS ARE PROUDLY DISPLAYED AS STUFFED SPECIMENS IN LIVING ROOMS. BRAZIL AND PERU ARE MAJOR SOURCES OF SMUGGLED FURS OF RARE SPECIES OF OCELOT, JAGUAR AND THE GIANT OTTER. IN KENYA, TOURIST SHOPS OFFER LION-TOOTH NECKLACES, ELEPHANT-FOOT WASTEBASKETS, MONKEY-SKIN BLANKETS, GIRAFFE-HAIR BRACELETS AND GAZELLE-SKIN COATS.

THE RICH PAY HIGH PRICES FOR THESE TREASURES SO IT IS DIFFICULT TO CONTROL AND PREVENT SUCH ILLEGAL TRADE BETWEEN COUNTRIES.

IN KENYA, AFRICA, ILLEGAL HUNTERS OR POACHERS HUNT LEOPARDS AND ELEPHANTS. A 70 LB. IVORY TUSK CAN BRING THE HUNTERS \$2,800 IN HONG KONG. THIS IS MORE THAN THE GAME WARDEN WILL FINE THEM IF THEY ARE CAUGHT POACHING.

IN CANADA'S GULF OF ST. LAWRENCE, HUNTERS SEARCH FOR NEWBORN SEALS IN THE EARLY SPRING. THE SLAUGHTER OF THESE YOUNG SEALS FOR FUR IS MOST DISTURBING.

IN INDONESIA, HUNTERS KILL THE ENDANGERED ORANGUTAN BY SHOOTING THE MOTHER HIDING IN THE TREES. THE YOUNG ARE CAUGHT AS THEY FALL FROM THE TREES.

AT INTERNATIONAL AIRPORTS A NUMBER OF RARE AND ENDANGERED SPECIES ARE SHIPPED TO FAR AWAY PLACES. OFTEN THESE WILD CREATURES ARE FOUND SUFFOCATED IN CAGES, NEVER REACHING PET SHOPS OR ZOOS.

IN HONG KONG THE RICH BUY RARE, ENDANGERED SPECIES OF WILDLIFE. THE CRAB EATING MONGOOSE, RIVER OTTER AND BARKING DEER ARE SUPPLIED BY IN DEALERS IN CHINA FOR GOURMET FEASTS.

1. PEOPLE → JUNGLE CATS → RATS
2. PEOPLE → CROCODILE →

WILD DOGS
SNAKES
WILD PIGS
3. PEOPLE → ALLIGATOR → FISH
4. PEOPLE → HIPPO → ALGAE → FISH

To Dam or Not to Dam

Curriculum Topic

MIDDLE EAST

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL POLICY
ECONOMICS, TECHNOLOGY & CULTURE

Grade Level(s)

7-8

Site

Classroom

Skills

Obtaining information,
using information for a purpose,
valuing skills

Author

Robert Slie

Objective

The student will be able to:

1. use the encyclopedia as a source of reference
2. recognize a conflict between progress (technology) and perserving the environment.
3. make a choice on a controversial issue.
4. pose alternative solutions to a problem.

To The Teacher

"...irrigation [is] bringing water from places having a surplus to those where there is not enough in order to raise crops. Irrigation has transformed thousands of square miles of barren desert into green, fruitful farmland. Lack of it has turned once-flourishing civilizations with thickly populated cities into silent, barren desert, where crumbling columns of great palaces and broken arches of aqueducts are slowly disappearing in the drifting sand." (Buehr) However, the construction of dams for irrigation projects has created many environmental hazards. A good example of such a situation is the Aswan High Dam in Egypt.

"Aswan High Dam controls the floodwaters of the Nile River in Egypt. It stands near the city of Aswan, on the northern shore of Lake Nasser in southeastern Egypt. For location, see EGYPT (political map). The dam measures 361 feet (110 meters) high and more than 2 miles (3.2 kilometers) long.

52_{te}

During the rainy season in late August, the Aswan High Dam holds back the rising waters of the Nile, which threaten to flood nearby land. The surplus water collects in Lake Nasser. Engineers created this lake, which extends 300 miles (480 kilometers) from the dam into Sudan. The water is used to irrigate farmland during dry periods and to generate electric power for factories and rural villages. Water supplied by the dam irrigates about 2 million acres (806 hectares) that had been unirrigated or poorly irrigated. The dam enabled Egypt to double its agricultural production.

The dam has seriously damaged the environment, in addition to providing benefits. For thousands of years, farmland along the Nile had been fertilized by "silt" (layers of earth particles) deposited by the floodwaters. Today, the dam prevents this water from flowing over the land, and so farmers must enrich the soil with expensive chemical fertilizers. The absence of silt has also increased the "erosion" (wearing away) of land along the Mediterranean coast near the Nile. In addition, the dam has caused poor drainage of nearby land.

Scientists also blame the dam for an alarming increase of a disease call "schistosomiasis", which causes serious intestinal and urinary infections. Schistosomiasis is transmitted by microscopic worms that breed in certain kinds of snails living along the Nile. The worms are discharged into the Nile, where they bore into the skin of people who wash clothes, bathe, or swim in the water. The annual flooding of the Nile once killed most of the snails. However, they have multiplied rapidly since the dam halted the floods.

Construction of the Aswan High Dam began in 1960 and was completed in 1970 at a cost of about \$1 billion. Russia provided technical assistance and over \$300 million in loans for the project. The high dam replaced the smaller Aswan Dam, which stands nearby and is used chiefly to generate electric power." (Spenser)

Before You Begin

Materials: Any encyclopedia, home or library sets; dittos (student handouts) 1. research assignment - questions found in "Activity" section; answers in "To the Teacher" section
2. "What's to be Done?" student page found at end of "Activity" section.

Words To Know

irrigation, hydroelectric, silt, erosion, schistosomiasis, technology environment, Sudan, continuum, alternative, brainstorm

ACTIVITY

1. Give an encyclopedia research assignment to students concerning the construction of the Aswan High Dam.
2. The following information should be obtained by the students using any standard encyclopedia:
 - a. Where is the Aswan Dam located?
 - b. When was it built? (started and completed)
 - c. Why was it built?
 - d. What are its dimensions?
 - e. What benefits have been received from its construction?
 - f. How has the construction of the dam affected the environment?
 - g. How has the construction of the dam created environmental problems?
3. Once the assignment is collected and/or reviewed, the students should receive the worksheet "What's to be Done?" for completion in groups of 4 or 5. Here the students can recognize, form opinions and provide solutions to the conflict caused by the construction of the dam.
4. The students should report and compare their findings and collectively come up with 3 reasonable alternative solutions.

Resources

Buehr, Walter. Water: Our Vital Need, New York, W.W. Norton & Company 1967, p. 45.

Spencer, William. "The Aswan High Dam", World Book Encyclopedia, Chicago, Field Enterprises, 1977, pp. 815-16.

Credit

"What's to be Done?" credited to Jane Hart, Environmental Education Center.

Related Activities

1. The class may develop a debate surrounding the conflict created by the construction of the dam.
2. Assign students a research essay based on the life of a fictitious young Egyptian who either a) benefits from the construction of the dam or b) is adversely affected by the construction of the dam.

Notes To Myself

- INDUM

CLOSE DOWN THE
OPERATION OF DAM

RUN THE DAM
AS USUAL

- SEARCH

HAVE BEEN DEVELOPED IN #2. THEN FOR EACH OF THE 3 ALTERNATIVES, LIST AS MANY CONSEQUENCES AS YOU CAN THINK OF.

ALTERNATIVE #3

- 1.
- 2.
- 3.
- 4.

The Plague

Curriculum Topic

MEDIEVAL HISTORY

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL POLICY,
ENVIRONMENTAL QUALITY

Grade Level(s)

7-8

Site

Classroom

Skills

Mapping data, organizing
information, using informa-
tion for a purpose

Author

Carla McGeeney

Objective

The students will be able to:

1. graphically illustrate the spread of the plague,
2. recognize the pattern of the spread as a wave,
3. give two reasons for environmental conditions underlying the spread of the plague.

To The Teacher

The Black Death was the greatest health crisis ever to hit Europe. Nearly thirty million Europeans died. The plague, which was actually three diseases - the bubonic plague and two more virulent forms, pneumonic and septicaemic - spread from Eastern Russia to China, India, and the Crimea, across the Black Sea to Europe. The trading towns of Italy were the first European towns affected. From them the disease spread in waves along the trade routes of the continent.

The vector for septicaemic plague, rarest of the three, is a flea which infects human beings with parasites. Pneumonic plague, the most infectious, is a disease of the lungs which can be transmitted with each breath. The most common of the three forms of the Black Death, bubonic plague, is spread to man by a flea which is carried by rats and other rodents. The conditions in Europe in 1347 were available to the spread of such epidemic diseases.

Europe was emerging from 200 years of sustained growth in prosperity and population. But the decades previous to 1347 had seen several severe crop failures and famines. Europe was overcrowded and in recession when the plague struck. In the towns, unhealthy living conditions such as careless piling of garbage, lack of any sewage disposal etc. were responsible for the presence of large rat populations. Still, though we think of the plague as an urban disease, most deaths occurred in the feudal farming villages. There, the people were worn by years of war and famine, and were psychologically prepared to meet death. Historian Philip Ziegler credits an attitude of resignation and a belief that the plague was divine retribution for unmentionable sin, with preventing a national response to the spread of the Black Death.

Today, advances in medicine, such as antibiotics, and more importantly those in public health, have made the plague a much less fearsome disease. Sanitary precautions limit the spread of rats, their fleas and the bacteria themselves. Though occasionally local outbreaks of plague still occur. The probability of another great pandemic is low. We have learned the importance of wise environmental management to the control of infectious disease.

Before You Begin

Preparation: You will have to show students how to first plan their charting mentally. Each series of cities should form a wave moving across Europe.

Words To Know

plague, Black Death, parasite

ACTIVITY

1. Discuss with the students the conditions in Europe at the time of the Plague.
2. Have them deduce what the environmental conditions in the cities were like at the time. (Help them to consider overcrowding and lack of sanitation.)
3. Give each student copies of the map of Europe and the plague data.
4. Have students draw a smooth curve by joining the points plotted on Student Page #2 to show the spread of the plague.
5. Discussion:
 - a. What conditions are necessary for a plague to spread?
 - b. Could there be a plague today?

Resources

Ziegler, Philip, The Black Death; John Day Company, 1969.

Credit

Environmental Science The Natural World Modules, Level 3, Silver Burdett Company, 1977, EEC #B240.

Steve Gold, contributor

Notes To Myself



STUDENT PAGE

EUROPE



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STUDENT PAGE

MONTH AND YEAR	NEW CITIES AFFECTED
1 December 1347	1 Genoa Marseille Naples Roma
2 June 1348	2 Angers Belgrade Bordeaux Madrid Paris Trieste Venice
3 December 1348	3 Bristol Budapest Lisbon London Munich Vienna Zurich
4 June 1349	4 Cologne Dublin Frankfurt Liverpool Krakow Norwich Prague
5 December 1349	5 Belfast Bergen Berlin Dresden Glasgow Hamburg
6 June 1350	6 North of Bergen Copenhagen Rostock Warsaw
7 December 1350	7 South of Riga Stockholm North of Trondheim

National Parks

Curriculum Topic

AMERICAN CONSTITUTION &
POLITICS
GEOGRAPHY - REGIONAL STUDIES
EARTH SCIENCE

Subject

Science

Environmental Topic

ENVIRONMENTAL POLICY

Grade Level(s)

7

Site

Classroom

Skills

Reading maps, using information for
a purpose

Author

Paul Kubicza

Objective

The student will be able to:

1. describe the distribution of the U.S. National Parks.
2. propose reasons for the preservation and expansion of the National Park System.

To The Teacher

There are 37 areas in the United States and its territories that are classified by acts of Congress, as national parks. They have such features as waterfalls, mountains, glaciers, canyons, caverns, lakes, streams and forests. Many national parks are important as wildlife refuges. Several western parks contain the nation's last heads of bison. Everglades National Park, in Southern Florida, is an important sanctuary for many animals, including rare and colorful birds. The Great Smoky Mountains National Park, in North Carolina and Tennessee, contains the largest tract of virgin hardwood in eastern North America.

In the years between 1900 and 1978 the National Park system has grown from 3,300,000 to 31,123,189 acres. Urban and paved areas (cities and roads) cover approximately 72,000,000 acres (3.1 percent of total U.S. land area). Thus the total area legislated to be national parks is less than one half as much as we are using for cities and roads.

The National Park Service, a bureau of the U.S. Department of the Interior, oversees national parks, monuments, and federal areas assigned to similar use. The functions of the service are to conserve plant life and wildlife in such great scenic and wilderness areas as Yellowstone National Park.

In 1934, about 4,000,000 persons visited the parks. This increased to 30,000,000 visitors in 1950 and 217,000,000 in 1974.

This activity will have students map locations of their state's national parks. Then, in analyzing the distribution of the parks, students will propose and examine reasons for the establishment and continued existence of the parks.

Before You Begin

Preparation: Prepare classroom copies of:

1. U.S. National Parks
2. Map of the United States

Words To Know

national parks, National Park Service, Department of the Interior, conservation



ACTIVITY

1. Pass out copies of Student Page #1 ("U.S. National Parks")
2. Explain to the class that the handout gives the name of the park, the state(s) in which it is located, the park size in acres, and a brief description of the park.
3. Pass out copies of Student Page #2 (map of the United States).
4. Demonstrate to students how to place the number of the park in the state in which it is located. (Ex. Arcadia National Park is number 1. Place a 1 in the state of Maine on the map. Arches National park is number 2. Place a 2 in the state of Utah on the map.)
5. To complete the map, students should devise a key which will indicate the approximate size of each park. For example:
 - = 50,000 acres; ⊙ = 100,000 acres; etc.
6. When students have completed recording the locations of the parks on the map, discuss the distribution of the parks with class. The following questions may be of value:
 - a. Which state has the largest number of parks?
 - b. Which state has the second largest number of parks?
 - c. Which states have no National Parks?
 - d. What regions of the United States have the most parks?
 - e. What park is closest to Connecticut?
 - f. What parks are located in the eastern U.S.?
 - g. Why are most of the parks located in the western U.S.?
 - h. What state is farthest from any park?
7. Discuss the National Park System. (Outside work by students may be necessary.)
 - a. Compare the sizes of the parks.
 - b. What special/important animals or other features are found in the parks?
 - c. Why are national parks established?
 - d. Should more national parks be created?
 - e. Where should new national parks be located? Why?
 - f. Are national parks a good method for protecting the natural environment?
 - g. What problems might arise from overuse of national parks by human beings?

Related Activities

1. Write to the Director, National Park Service, U.S. Department of the Interior, Washington, DC 20240 for information on the National Park System.
2. Have students write to the individual parks for information on the parks.

3. Have students add up the total areas of the national parks and compare it with the size of the United States (2,270,050,000 acres). Compare the sizes of some of the large parks with the sizes of some states (Rhode Island = 671,000 acres; Connecticut = 3,116,000 acres; California = 100,091,000 acres; Alaska = 365,481,000 acres).

4. Investigate the similarities and differences between:

- a. national wilderness areas,
- b. national wildlife refuges,
- c. national parks,
- d. national forests,
- e. national monuments, and
- f. national estuaries.

5. Investigate the ownership of forest lands and compare the amounts of forested areas in different states. ("Forest Facts and Figures" is an excellent resource.)

Resources

America's Wonderlands: The National Parks, ed. M. Severy, National Geographic Society, 1960.

"Forest Facts and Figures," American Forest Institute, Washington, DC 1976.

"National Parks of the United States Map and Guide", U.S. Dept. of the Interior, Washington, DC.

Melbo, I., Our Country's National Parks, Bobbs-Merrill, 1973.

Project Learning Tree, The American Forest Institute, Inc., 1977, Activity 39, EEC # 400.3.

The World Almanac and Book of Facts 1978, ed., G. Delury, Newspaper Enterprise Association, 1977, pp 461-463.

Notes To Myself

STUDENT PAGE

NATIONAL PARKS OF THE UNITED STATES

- 1) ACADIA, ME. (1916) 41,651. INCLUDES MOUNT DESERT ISLAND, HALF OF ISLE AU HAUT, SCHOODIC POINT ON MAINLAND. HIGHEST ELEVATION ON EASTERN SEABOARD.
- 2) ARCHES, UTAH (1929) 73,389. CONTAINS GIANT RED SANDSTONE ARCHES AND OTHER PRODUCTS OF EROSION.
- 3) BIG BEND, TEXAS (1935) 708,118. ON RIO GRANDE RIVER.
- 4) BRYCE CANYON, UTAH (1923) 36,034. SPECTACULAR COLORFUL AND UNUSUAL DISPLAY OF EROSION EFFECTS IN SOUTHWESTERN UTAH.
- 5) CANYONLANDS, UTAH (1964) 344,482. AT JUNCTION OF COLORADO AND GREEN RIVERS, EXTENSIVE EVIDENCE OF PREHISTORIC INDIANS.
- 6) CAPITOL REEF, UTAH (1937) 241,866. A 70-MILE UPLIFT OF SANDSTONE CLIFFS DISSECTED BY HIGH-WALLED GORGES.
- 7) CARLSBAD CAVERNS, NM (1923) 46,756. LARGEST KNOWN UNDERGROUND CAVERNS, NOT YET FULLY EXPLORED.
- 8) CRATER LAKE, ORE. (1902) 160,290. EXTRAORDINARY BLUE LAKE IN CRATER OF EXTINCT VOLCANO ENCIRCLED BY LAVA WALLS 500 TO 2,000 FEET HIGH.
- 9) EVERGLADES, FLA. (1934) 1,400,533. LARGEST REMAINING SUBTROPICAL WILDERNESS IN CONTINENTAL U.S., ABUNDANT WILDLIFE INCLUDES RARE BIRDS.
- 10) GLACIER, MONT. (1910) 1,013,277. SUPERB ROCKY MOUNTAIN SCENERY, NUMEROUS GLACIERS AND GLACIAL LAKES. PART OF WATERTON-GLACIER INTERNATIONAL PEACE PARK ESTABLISHED BY U.S. AND CANADA IN 1932.
- 11) GRAND CANYON, ARIZ. (1908) 673,561. MOST SPECTACULAR PART OF COLORADO RIVER'S GREATEST CANYON.
- 12) GRAND TETON, WYO. (1929) 310,463. MOST IMPRESSIVE PART OF THE TETON MOUNTAINS, WINTER FEEDING GROUND OF LARGEST AMERICAN ELK HERD.
- 13) GREAT SMOKY MOUNTAINS, NC-TN. (1926) 516,860. LARGEST EASTERN MOUNTAIN RANGE, MAGNIFICENT FORESTS.
- 14) GUADALUPE MOUNTAINS, TEXAS (1966) 79,972. EXTENSIVE AND SIGNIFICANT PERMAIN LIMESTONE FOSSIL REEF; TREMENDOUS EARTH FAULT. INFORMATION OFFICE OPEN: NO OTHER FACILITIES.
- 15) HALEAKALA, HAWAII (1960) 27,283. 10,023 FOOT DORMANT VOLCANO ON MAUI.
- 16) HAWAII VOLCANOES, HAWAII (1916) 229,174. CONTAINS KILAUEA AND MAUNA LOA, ACTIVE VOLCANOES ON THE ISLAND OF HAWAII.

- 17) HOT SPRINGS, ARK. (1832) 5,729. GOVERNMENT SUPERVISED BATH HOUSES USE WATERS OF 45 OF THE 47 NATURAL HOT SPRINGS.
- 18) ISLE ROYALE, MICH. (1931) 539,498. LARGEST ISLAND IN LAKE SUPERIOR, NOTED FOR ITS WILDERNESS AREA AND WILDLIFE.
- 19) KINGS CANYON, CALIF. (1890) 460,134. MOUNTAINS WILDERNESS, DOMINATED BY KINGS RIVER CANYONS AND HIGH SIERRA, CONTAINS GIANT SEQUOIAS.
- 20) LASSEN VOLCANIC, CALIF. (1907) 106,446. CONTAINS LASSEN PEAK, MOST RECENTLY ACTIVE VOLCANO IN CONTINENTAL U.S., AND OTHER VOLCANIC PHENOMENA.
- 21) MAMMOTH CAVE, KY. (1926) 51,311. 144 MILES OF SURVEYED UNDERGROUND PASSAGES, BEAUTIFUL NATURAL FORMATIONS, RIVER 360 FEET BELOW SURFACE.
- 22) MESA VERDE, COLO. (1906) 52,036. MOST NOTABLE AND BEST PRESERVED PREHISTORIC CLIFF DWELLINGS IN THE UNITED STATES.
- 23) MOUNT MCKINLEY, ALASKA. (1917) 1,939,493. HIGHEST MOUNTAIN IN NORTH AMERICA, LARGE GLACIERS, AND UNUSUAL WILDLIFE.
- 24) MOUNT RAINIER, WASH. (1899) 235,404. GREATEST SINGLE-PEAK GLACIAL SYSTEM IN THE U.S. RADIATES FROM THIS DORMANT VOLCANO
- 25) NORTH CASCADES, WASH. (1968) 505,000. SPECTACULAR MOUNTAINOUS REGION WITH MANY GLACIERS, LAKES, AND RUGGED PEAKS.
- 26) OLYMPIC, WASH. (1909) 897,360. MOUNTAIN WILDERNESS CONTAINING FINEST REMNANT OF PACIFIC NORTHWEST RAIN FOREST, ACTIVE GLACIERS, PACIFIC SHORELINE, RARE ELK.
- 27) PETRIFIED FOREST, ARIZ. (1906) 94,189. EXTENSIVE PETRIFIED WOOD AND INDIAN ARTIFACTS. CONTAINS PART OF PAINTED DESERT.
- 28) REDWOOD, CALIF. (1968) 56,238. FORTY MILES OF PACIFIC COASTLINE, VIRGIN GROVES OF ANCIENT REDWOODS.
- 29) ROCKY MOUNTAIN, COLO. (1915) 261,973. BEAUTIFUL SCENERY ON THE CONTINENTAL DIVIDE INCLUDES 197 NAMED PEAKS OVER 11,000 FEET.
- 30) SEQUOIA, CALIF (1890) 386,822. GROVES OF GIANT SEQUOIAS, LARGEST MOUNTAIN IN CONTERMINOUS UNITED STATES - MOUNT WHITNEY (14,494 FEET).
- 31) SHENANDOAH, VA. (1926) 194,248. PORTION OF THE BLUE RIDGE MOUNTAINS; THIS PARK OVERLOOKS MUCH OF THE FAMOUS SHENANDOAH VALLEY.
- 32) VIRGIN ISLANDS, VIRGIN ISLANDS (1956) 14,470. COVERS 3/4 OF ST. JOHN ISLAND, LUSH GROWTH, LOVELY BEACHES, INDIAN RELICS, EVIDENCE OF COLONIAL DANES.
- 33) VOYAGEURS, MINN. (1971) 219,128. ABUNDANT LIAKES, FORESTS, WILDLIFE, UNUSUAL RECREATIONS. LIMITED FACILITIES.

34) WIND CAVE, SD (1903) 28,060. LIMESTONE CAVERNS IN BLACK HILLS. EXTENSIVE WILDLIFE INCLUDES A HERD OF BISON.

35) YELLOWSTONE, IDA, MONT, WYO. (1872) 2,219,823. OLDEST AND LARGEST NATIONAL PARK. WORLD'S GREATEST GEYSER AREA HAS ABOUT 3,000 GEYSERS AND HOT SPRINGS; THE SPECTACULAR FALLS AND IMPRESSIVE CANYONS OF THE YELLOWSTONE RIVER ARE MAJOR ATTRACTIONS.

36) YOSEMITE, CALIF. (1890) 761,155. YOSEMITE VALLEY, THE NATION'S HIGHEST WATERFALL, 3 GROVES OF GIANT SEQUOIAS, AND MOUNTAINOUS TERRAIN.

37) ZION, UTAH (1909) 146,845. UNUSUAL SHAPES AND LANDSCAPES HAVE RESULTED FROM THE EFFECTS OF EROSION AND FAULTING ACTIVITY. ZION CANYON, WITH SHEER WALLS RANGING UP TO 2,500 FEET, IS READILY ACCESSIBLE.



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STUDENT PAGE



Wasting Away

Curriculum Topic

CURRENT EVENTS

Subject

Science or Social Studies

Environmental Topic

ENVIRONMENTAL POLICY

Grade Level(s)

7,8

Site

Classroom

Skills

Problem-solving skills,
valuing skills, brainstorming
group skills

Author

Pat Perrella

Objective

As a team students will be able to:

1. develop a plan for a given problem.
2. examine alternatives and
3. identify the consequences of these alternatives.

To The Teacher

Many towns are currently faced with the problem of developing alternative methods of disposing of their garbage. As a result of increased population in the U.S. and the "overpackaged" life-style it has assumed we spend approximately 4.5 billion annually to collect and dispose of garbage. Some of the former methods of garbage disposal are no longer effective; most cities are running out of dumping grounds and burning increases the problem of air pollution. In this activity, students are asked to design alternative methods of waste disposal. Some ideas students might consider and develop are dumping the garbage in the ocean, paying another town for use of its dumping grounds, buying a huge garbage compactor, creating a new dump or recycling.

In all likelihood, the discussion will be animated as alternatives are discussed within the small groups. This excitement is valuable to the brainstorming technique. If a group is having difficulty developing ideas, you may offer one alternative as an example, but allow them to create additional alternatives.

ACTIVITY

1. Divide students into groups of 4 or 5 students. Explain that they comprise the Town Council of Ailingtown which is seeking alternative methods of waste disposal because the town dump is inadequate. (See Student Activity Sheet)
2. Ask the students to design as many alternatives as possible to solve the problem. After completing the list, have each Council list the advantages and disadvantages of the alternatives. This is called a consequences search.
3. After the consequences search, have each council select one alternative as the optimum choice.
4. Each group (town council) then writes its proposal on the chalk board.
5. Have a representative of each council explain its proposal and the reasons why this proposal should be selected by the taxpayers.
6. Finally, a town-wide (class-wide) referendum is held to select the best alternative for waste disposal.

Related Activities

1. Have students investigate the ways in which their town disposes of its waste. Is it the same method that was used 20 years ago?

Resources

The Environmental Handbook, ed. Garret de Bell, Ballantine Books, 1970, p. 140-141.

Simon, S., L. Howe, H. Kirschenbaum, Values Clarification, Hart Publishing co., 1972, p. 193-196.

Words To Know

referendum, landfill

Notes To Myself

STUDENT PAGE

YOU ARE A MEMBER OF THE TOWN COUNCIL OF AILINGTOWN AND YOU ARE FACED WITH A SERIOUS PROBLEM. THE POPULATION IN YOUR COMMUNITY HAS INCREASED RAPIDLY IN THE PAST FEW YEARS AND THE OLD TOWN DUMP IS NO LONGER ADE- QUATE FOR GARBAGE DISPOSAL. AMERICA, INCLUDING THE CITIZENS OF AILING- TOWN, PRODUCE GARBAGE IN GREATER AMOUNTS THAN ANY OTHER NATION IN THE WORLD: MORE THAN 5 POUNDS PER DAY FOR EACH PERSON.

BEING INTELLIGENT PEOPLE, YOU REALIZE THAT THE TOWN MUST ACT IMMEDIATELY TO SOLVE THIS PROBLEM OF WASTE DISPOSAL. FIRST, HOWEVER, YOU MUST EXAMINE ALL POSSIBLE ALTERNATIVES BEFORE MAKING A DECISION. DISPOSAL IS AN ISSUE OF GREAT CONCERN WHICH HAS AROUSED DISAGREEMENT AMONG THE CITIZENS OF AILINGTOWN. THEREFORE, A TOWN-WIDE REFERENDUM HAS BEEN PLANNED TO CHOOSE AN ALTERNATIVE GARBAGE DISPOSAL METHOD. COUNCIL- PERSON CLAIR WILSON IS AT HOME ILL, BUT SHE HAS PROPOSED TWO SUGGESTIONS FOR YOUR CONSIDERATION: 1) THERE IS AN OLD PARK IN THE SOUTH SIDE OF TOWN THAT COULD EASILY BE RECONVERTED INTO A LANDFILL AREA WHERE WASTES ARE COMPACTED AND BURIED UNDER SOIL TO DECOMPOSE; 2) A NEW INCINERATOR CAN BE BUILT TO BURN THE GARBAGE.

THE JOB IS NOW UP TO YOU. THINK OF AS MANY ALTERNATIVES AS POSSIBLE AND LIST THEM IN TABLE 1. THEN LIST ALL THE ADVANTAGES AND DISADVANT- AGES OF EACH. IN A GROUP WILL DECIDE WHICH ALTERNATIVE IS THE BEST TO PROPOSE TO THE TOWNSPEOPLE. GOOD LUCK!

ONE EXAMPLE ALTERNATIVE HAS ALREADY BEEN CONSIDERED FOR ITS ADVANTAGES AND DISADVANTAGES. YOU COMPLETE THE REST OF THE CHART.

TABLE 1

ALTERNATIVES	ADVANTAGES	DISADVANTAGES
1. Build landfill	sanitary, rather inexpensive	will eliminate a park, will not be pleasing to look at, will affect plants & animals living in the park
2. Build incinerator		

BHA & BHT

Curriculum Topic

CHEMISTRY

Subject

Science

Environmental Topic

ENVIRONMENTAL POLICY

Grade Level(s)

7, 8

Site

Classroom

Skills

Reading

Identifying alternatives

Author

Paul Kubicza

Objective

The student will be able to:

1. describe the uses of BHA and BHT
2. discuss critically the evidence for and against the use of BHA and BHT.

To The Teacher

BHT (butylated hydroxytoluene) and BHA (butylated hydroxyanisole) are substances added to a variety of food products containing oils to prevent spoilage, which occurs when food oils combine with oxygen from the air (oxidation). BHT and BHA are added to cereals, crackers, soups, shortenings, whipped dressings, chewing gum, enriched rice, potato chips, bread and many other prepared and convenience foods.

BHA has been used in food since 1947, BHT since 1954. Currently, tens of thousands of pounds of both synthetic chemicals are used annually. The combined concentration of these substances in foods ranges from 0.001 per cent in gelatin desserts to 0.1 per cent in chewing gum and dried yeast.

The Food and Drug Administration has established a category of food additives which are "Generally Recognized As Safe" (GRAS). The GRAS category was created to exempt unquestionably safe chemicals, such as starch, salt, sugar, baking soda, protein, etc., from the costly toxicological tests required by the 1958 food additive law. Both BHA and BHT are on the GRAS list. The law states that chemicals used in food prior to January 1, 1958 could be deemed GRAS without scientific testing. Chemicals introduced to the food supply after that date may not be declared GRAS unless scientific tests indicate safety. Both BHA and BHT were used in foods well before 1958 and are therefore on the GRAS list.

Most GRAS chemicals have been used in foods for many years and are undoubtedly safe. Because of inadequate testing, many unsafe chemicals appear on the GRAS list. Cyclamate was on the list in 1969 although it was later found to be carcinogenic. Brominated vegetable oil was on the list in 1970, although it was later found to be toxic. The FDA announced in 1971 that it would reexamine the toxicity of all GRAS compounds and conduct tests on many of them. It is a safe bet that several will be removed from the list.

BHA and BHT are currently listed as "Generally Recognized As Safe". A number of studies have been conducted on the two additives over the past few years. Some of the studies conclude that the two chemicals are dangerous and others conclude that the chemicals are harmless. And some studies claim the chemicals are beneficial to health. These conflicting test results only point to the need for further testing. Meanwhile, we must remain in doubt as to the actual effects on the human body of BHA and BHT.

Before You Begin

Prepare class copies of Study Sheet 1 and Study Sheet 2.

Words To Know

additive, preservative, BHA, BHT, anti-oxidant, oxidized, control group, parts per million (ppm)

ACTIVITY

1. Introduce the activity by describing the function of food preservatives. Introduce BHA and BHT as two of the most widely used preservatives in America today.
2. Pass out copies of BHT and BHA Study Sheet I.
3. Have class read the sheet silently or have students take turns reading orally.
4. Discuss with class the following questions:
 - a) What are BHA and BHT used for?
 - b) Are BHA and BHT safe to use? Why or why not?
 - c) What benefits do BHA and BHT have for people?
 - d) Have BHA and BHT been tested for safety? What were the results?
5. Proceed as before with Study Sheet II. Discuss the following questions with the class:
 - a) What effects do BHA and BHT have on rats?
 - b) Do you think chemicals and drugs have the same effect on laboratory test animals as they do on humans?
 - c) Why are chemicals tested on laboratory animals rather than on humans?
 - d) Are BHA and BHT safe to use? Why or why not?
 - e) Which evidence do you believe, for or against BHA and BHT use?
 - f) Why are the results of the studies so different?
 - g) Is there anyone who guards the public against dangerous chemicals in food?
 - h) What must be done to prove BHA and BHT safe or unsafe?

Related Activities

Related Activities:

1. Have the students examine the groceries they have at home and record the names of those containing BHA or BHT.
2. Write to the Food and Drug Administration for information on food additives.
3. Investigate the laws and agencies that protect the public's food.
4. Find out the differences between natural and synthetic food additives.
5. Bring in samples of bread with and without preservatives. Leave the samples out on a table for a few days and compare what happens.

Resources

Jacobsen, Michael F., Eater Digest: The Consumers' Factbook of Food Additives, Anchor Books, 1972, pp. 85-89, 244-245

Silverstein, Dr. Alvin and V. Silverstein, The Chemicals We Eat and Drink, Follet Publishing Co., 1973, pp. 42-45

Whelan, Dr. Elizabeth M. and F.J. Stare, M.D., Panic in the Pantry, Atheneum, 1976, pp. 122-128



Cartoon by Larry Barton

STUDENT PAGE I
BHA AND BHT STUDY SHEET I

BHA (butylated hydroxytoluene) and BHT (butylated hydroxyanisole) are two chemicals that are added to a variety of food products containing oils to prevent spoilage, which occurs when food oils combine with oxygen from the air (oxidation). BHA and BHT are added to cereals, crackers, soups, shortening, bread, prepared foods and chewing gum.

One researcher fed a group of mice a diet containing half a per cent of BHT and found that these mice lived forty-five per cent longer than a control group fed a diet without the additive.

Another research team found that both BHT and BHA (as well as a natural anti-oxidant, Vitamin E) provide protection against two common air pollutants, nitrogen dioxide and ozone. In studies on rats these chemical protectors slowed down oxidation of fatty substances in the lungs of the rats and helped them to live longer than a group of rats exposed to the pollutants and not given BHA or BHT.

These chemicals were in widespread use after 1947. They were tested for safety in the 1950's and 1960's. Studies began to show that not only were BHA and BHT not harmful to health, but it appeared that they had the capacity to prevent cancer.

In laboratory experiments, it was confirmed that when BHT was added to the diets of mice, there was a marked reduction in stomach cancer. It is not known if BHT reduces stomach cancer in people.

Between 1930 and 1947 there was little change in the number of people with stomach cancer. BHA was used in foods extensively beginning in 1947. After 1948 there was a significant decrease in the number of people with stomach cancer.

The United States, Australia, Canada and New Zealand have the lowest rates of stomach cancer in the world today. BHA and BHT are used in many foods in these countries.

In Austria, Bulgaria, Czechoslovakia, Finland, Hungary, Italy, Poland and West Germany there is very little use of BHA and BHT. These countries have the highest death rates in the world from stomach cancer.

Scientists have concluded that small amounts of BHA and BHT do not exert harmful effects on the body and may in fact be beneficial. The World Health Organization of the United Nations has announced that BHA and BHT are safe for use in foods.

STUDENT PAGE II
BHA AND BHT STUDY SHEET II

Synthetic chemicals, including BHA and BHT, are added to many brands of vegetable oil and shortening to prevent them from going rancid. Some companies have discovered that improved manufacturing procedures eliminate the need for these additives. Crisco shortening, Wesson vegetable oil, Planter's peanut oil and Safeway's gelatin desserts do not contain these synthetic preservatives and are just as tasty and economical as products with BHA and BHT.

In 1959 Australian biologists reported experiments in which BHT caused the hair on the heads of rats to fall out, increased cholesterol levels in the blood, and caused rats to be born without eyes.

Another researcher claimed that these preserving agents, when fed to pregnant laboratory animals, brought about brain changes and resulted in abnormal behavior patterns in rats.

Other scientists have found that BHA and BHT stimulate the liver to produce detoxification enzymes. These hasten the destruction and reduce the effectiveness of many medicines.

Scientists in England have recently discovered levels of BHT as high as 3 parts per million (ppm) in human fatty tissue. The average level of BHT was six times as high in the fat of Americans (1.3 ppm) as in the fat of Englishmen (0.2 ppm). We should be suspicious of any synthetic chemical that accumulates in our bodies.

The Case of Weather Power

Curriculum Topic

METEOROLOGY - Weather manipulation

Subject

Science

Environmental Topic

ENVIRONMENTAL POLICY - Effective environmental policy decision requires consideration of ecological, economic, political and socio-technological aspects of the issue.

Grade Level(s)

6 - 8

Site

Classroom

Skills

Communicating information
Developing a plan of action
Identifying consequences of alternatives

Author

Thomas J. Kotulski
Patricia Marshall

Objective

Student will be able to:

1. distinguish between alternate proposals offered by interest groups
2. propose and defend reasons for acceptance of a proposal.

To The Teacher

Our world is characterized by rapid change and the ambiguity and uncertainty which accompany change. Revolutions in technology, communications and transportation continue and continue to increase the complexity of lifestyles. Interactions between the U.S. and other nations of the world have, meanwhile, become more complex and more demanding upon the privilege which has been that of U.S. citizens: the privilege of privacy and individual freedom. This freedom is no longer ours to easily assume. The frontier personality of the U.S., with all its attendant assumptions of room and privilege is changing, as control and the requirements for control-mediation assume a focus of our attention. Now we must know large-scale issues and be prepared to work for the control which affords us all the greatest value of the greatest goods and purposes. That is, we must learn and value an increasing ability to see alternatives and to make choices from them, rather than assume that any alternative we desire is immediately ours.

Weather modification is no new attempt. The rain-dance, for example, is familiar to us from American Indian culture. Accidental weather modifications are perhaps more familiar: large and numerous areas of black topping, for example, have created urban heat islands which have caused an increase in the formation of down-wind clouds. In recent years, scientists have effected weather modifications for particular purposes. Rainmaking has been accomplished through cloud seedlings with silver iodide, silver nitrate and frozen CO₂, each of which stimulates cloud formation to increase the possibility of precipitation.

In 1973, clouds of a hurricane which had formed off the Bermuda Coast were seeded in an attempt to control the force of the hurricane. By causing precipitation at a critical stage of the storm's development, energy could be dispersed to reduce probable storm damage. Data indicate that the hurricane was, in fact, stalled. But, while it was stalled it regathered the energy meteorologists had hoped to disperse.

Before You Begin

Make copies of student page. You will need one copy for every 3 students. Cut student page into three sections on dotted lines.

Words To Know

weather modification, public hearing, policy-making, EPA



Courtesy British Columbia Wildlife Review

"Some day we'll look back and laugh at all this."

Conservation News 7-1-74

ACTIVITY

1. As a class, discuss methods used in weather modification and their side effects.
2. Divide class into three groups. One group will represent a retired worker, another a farmer, and the third group a citizen in an adjacent town. Give each student a copy of the role he/she is to play.
3. Explain to the class that each class group has the responsibility of representing in their assigned roles their role before the President's Commission on Weather Modification. The President's Commission on Weather Modification must make a recommendation to the President and Congress concerning continuation of the country's weather modification program. The teacher can represent the Commission or select one student from each group to be the Commission.
4. Have each group prepare their testimony for the Commission. Each should establish a recommended policy of weather modification designed from the knowledge of their own experience in Sleeping Giant Valley. This policy must be just and equitable for everyone concerned.
5. When each group has held its planning session, the Commission holds a public hearing. After the public hearing, the Commission must make its recommendation.
6. Allow the class to discuss the Commission's findings. The following questions are suggested for discussion:
 - a. Should weather-control be allowed or prohibited?
 - b. Who should determine a solution? What should be the basis of the solution?
 - c. How is this issue similar to the one faced by people living near jet airports?
 - d. Relate the decision-making scene just played with the following: The EPA of Los Angeles has suggested that the only way to reduce air pollution is to ration gasoline until traffic is reduced 80% of its present amount. One citizen has commented, "I have three cars. No one has the right to tell me when I can or cannot drive!"
 - e. To what extent is a government responsible for the impact of its acts upon neighboring nations? What alternatives and consequences do you see?

Resources

- Gordon, Theodore T., The Future; St. Martin's Press, 1965
- "Man and Nature", Anthony F. Wiener, Social Speculations, ed. R. Kustalametz; William Morrow & Co., 1971

Credit

- Wagner, Richard H., Environment and Man; Norton Publishing Co., Inc., 1971, chap. 19

STUDENT PAGE

RETIRED WORKER

After a decade of work, you have finally saved enough money to buy a small summer home on a remote lake. It was what you always wanted: beautiful, rustic, and remote, with only a few neighbors on the lake shores.

Then came the New Federal Weather Control Program (FWCP). As a result of this program, rainclouds have been deviated to farmland, while your lake has begun to disappear. Not only have the streams which feed the lake dried up, but the surrounding woods show signs of succumbing to the man-made drought. You have tried to sell your property to move elsewhere, but have had no success. You and other property owners have sent petitions to FWCP and talked to your congressional representatives. In general, their reactions show understanding of your situation. National priorities, however, require the opening up of new farm land.

FARMER

The year is 1985. As a landowner of Sleeping Giant Valley, you are delighted with the New Federal Weather Control Program (FWCP). Your valley, has been turned from a barren wasteland into valuable farmland. New farmland is badly needed by the country. Many food items, especially fresh fruits, have become scarce as the population of the U.S. has soared past 250 million. You have developed a farm which specializes in fruit.

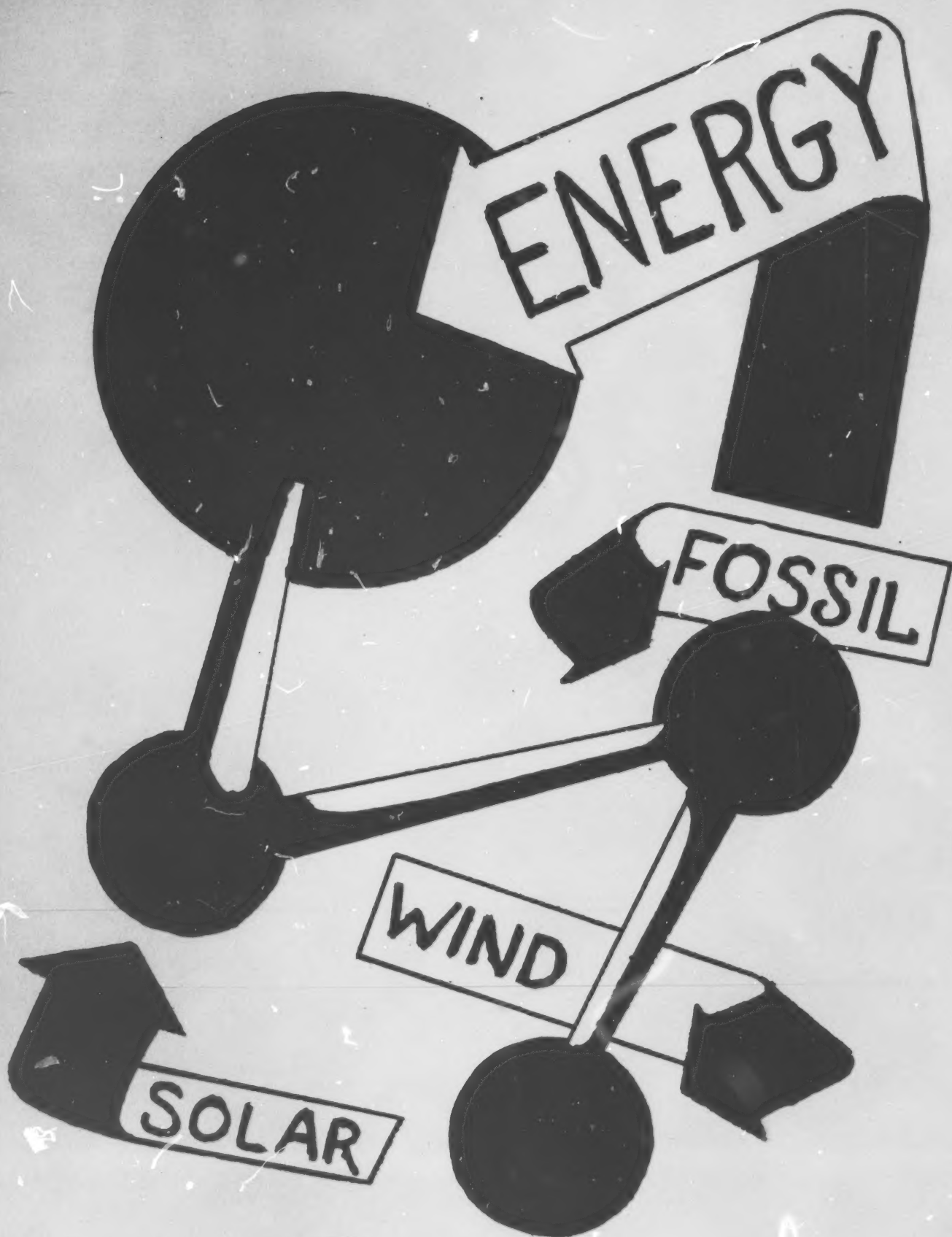
You have become wealthy by these new developments, but do not feel that your wealth indicates greed or selfishness on your part. You bought the land when it was worthless, and your prosperity has simply been a reflection of the nation's progress. Indeed, everyone has benefited!

CITIZEN

As a citizen of a small town next to Sleeping Giant Valley, your life has been disrupted by the Federal Weather Control Program (FWCP). Twice last year, heavy storms that threatened the valley and its crops were diverted to your area and caused considerable damage in your town.

Homes were washed out and farms ruined. Though the government provided flood-damage insurance payment, the effort to restore and the fear of repeated damage has been great.

What will happen if more violent weather conditions develop over the valley? Weather controllers promised to try to avoid damaging your town, but weather control techniques are not perfect and their errors have resulted in the floods of the past years. Nor are you assured now that the U.S. government will pay again for flood damage.



ENVIRONMENTAL ETHICS



ENVIRONMENTAL ETHICS

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ENVIRONMENTAL ETHICS

"It is essential for effective citizen participation that there be an understanding of the prevalent moral attitudes, principles and values (i.e. ethics) that shape environmental policy. To create this understanding, we can examine the development of prevalent worldviews as a basis for policy evaluation. A worldview exemplifies one set of ethics, based upon a set of beliefs about the basic nature of humanity, nature, and the universe: what we assume to be true, and what we hope or think will become true.

For some two hundred years, the industrial worldview has dominated and shaped major goals, priorities, and social structures throughout the Western world. Recently, many observers and analysts of societal and cultural developments have interpreted the present period of rapid change as constituting a major break with past standards, perceptions, and assumptions about the nature of the world and humanity. In other words, we are currently undergoing a shift in worldview. As such, a change of this magnitude will have a fundamental effect on social, political, economic and technological interrelationships, and will have direct implications for energy and environmental policy and practices at the individual and aggregate levels

What does this shift in worldview mean to educators? It means preparing students for a new world.

Environmental concern will be short-lived if we do not deal with the attitudes and values that have led to environmental deterioration. An environmental ethic is a disposition in a person's life that allows them to act according to the values they cherish. That requires both an awareness and a reevaluation of beliefs and actions that the conflicts can be resolved.

Environmental education can expose students to pollution. It can demonstrate that $\text{population} \times \text{per capitata consumption} \times \text{environmental impact} = \text{ecosystem disruption and pollution}$. It can even cause students to recognize that the world is finite and that life-support systems as we know them are vulnerable. But unless we move students to an ethic of creative earth stewardship, their worldview has not been changed.

This environmental ethic balances resource use with preservation and avoids both the tyranny of survival and the tyranny of individualism. Its goals can best be summarized in a set of new ethical guidelines:

1. Man is not the source of all value.
2. Man must be the wise caretaker and steward of the earth for present and future generations.
3. Man's primary purpose is not to produce and consume but to conserve and renew, replenish not ravage the earth.
4. Improvement of life quality, not ever-increasing production and consumption of material things, must be our goal.
5. Earth resources are finite and must be cherished and renewed, not wasted.

6. Man's relationship to nature must be that of man and nature, a symbiotic partnership based on ecological understanding and cooperation.
7. Man is to preserve stability and enhance life quality by preserving and encouraging physical, biological, and cultural diversity.
8. A major function of the state is to supervise long range planning and to prevent individuals and corporations from exploiting or impairing the quality of the environment and human freedom and dignity.
9. Because no one can or should exclusively do his or her own thing, the ideal human goal is that of sharing and caring, not complete individualism and domination.
10. Each human being on this planet is unique, unprecedented, and has a right to a basic share of the ecosystem's resources.
11. No individual, corporation, or nation has a right to an ever-increasing share of the earth's finite resources.²

¹High School Energy/Environmental Education Teacher Training Model: Content Sourcebook prepared by Far West Laboratory for Educational Research and Development, 1978 (Draft Version).

²G. T. Miller, Jr., Living in the Environment-Concepts, Problems and Alternatives, 1975, Wadsworth Publishing Co., California -. 365.

ENVIRONMENTAL ETHICS

"It is essential for effective citizen participation that there be an understanding of the prevalent moral attitudes, principles and values (i.e. ethics) that shape environmental policy. To create this understanding, we can examine the development of prevalent worldviews as a basis for policy evaluation. A worldview exemplifies one set of ethics, based upon a set of beliefs about the basic nature of humanity, nature, and the universe: what we assume to be true, and what we hope or think will become true.

For some two hundred years, the industrial worldview has dominated and shaped major goals, priorities, and social structures throughout the Western world. Recently, many observers and analysts of societal and cultural developments have interpreted the present period of rapid change as constituting a major break with past standards, perceptions, and assumptions about the nature of the world and humanity. In other words, we are currently undergoing a shift in worldview. As such, a change of this magnitude will have a fundamental effect on social, political, economic and technological interrelationships, and will have direct implications for energy and environmental policy and practices at the individual and aggregate levels

What does this shift in worldview mean to educators? It means preparing students for a new world.

Environmental concern will be short-lived if we do not deal with the attitudes and values that have led to environmental deterioration. An environmental ethic is a disposition in a person's life that allows them to act according to the values they cherish. That requires both an awareness and a reevaluation of beliefs and actions that the conflicts can be resolved.

Environmental education can expose students to pollution. It can demonstrate that $\text{population} \times \text{per capitata consumption} \times \text{environmental impact} = \text{ecosystem disruption and pollution}$. It can even cause students to recognize that the world is finite and that life-support systems as we know them are vulnerable. But unless we move students to an ethic of creative earth stewardship, their worldview has not been changed.

This environmental ethic balances resource use with preservation and avoids both the tyranny of survival and the tryanny of individualism. Its goals can best be summarized in a set of new ethical guidelines:

1. Man is not the source of all value.
2. Man must be the wise caretaker and steward of the earth for present and future generations.
3. Man's primary purpose is not to produce and consume but to conserve and renew, replenish not ravage the earth.
4. Improvement of life quality, not ever-increasing production and consumption of material things, must be our goal.
5. Earth resources are finite and must be cherished and renewed, not wasted.

6. Man's relationship to nature must be that of man and nature, a symbiotic partnership based on ecological understanding and cooperation.
7. Man is to preserve stability and enhance life quality by preserving and encouraging physical, biological, and cultural diversity.
8. A major function of the state is to supervise long range planning and to prevent individuals and corporations from exploiting or impairing the quality of the environment and human freedom and dignity.
9. Because no one can or should exclusively do his or her own thing, the ideal human goal is that of sharing and caring, not complete individualism and domination.
10. Each human being on this planet is unique, unprecedented, and has a right to a basic share of the ecosphere's resources.
11. No individual, corporation, or nation has a right to an ever-increasing share of the earth's finite resources.²

¹High School Energy/Environmental Education Teacher Training Model: Content Sourcebook prepared by Far West Laboratory for Educational Research and Development, 1978 (Draft Version).

²G. T. Miller, Jr., Living in the Environment-Concepts, Problems and Alternatives, 1975, Wadsworth Publishing Co., California -. 365.

Find the Assumption

Curriculum Topic

WESTWARD EXPANSION

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL ETHICS- America has incorporated a growth ethic which has its roots in the early days of the Republic into its massthinking.

Grade Level(s)

7 - 8

Site

Classroom

Skills

Analyzing and evaluating information
Identifying alternatives

Author

Steve Gold

Objective

The student will be able to:

- 1) distinguish between statements of fact and statements of value
- 2) distinguish between primary and secondary sources
- 3) specify assumptions implicit in written statements

To The Teacher

The base for America's industrial economy was first laid in the initial part of the nineteenth century. While America in 1800 was rural, composed largely of small self-sufficient towns connected by but few roads, "by 1850 the contours of a vast economic revolution were plainly visible... Commercial agriculture had replaced subsistence agriculture in many areas. Local self-sufficiency had given way steadily to specialized production and increased trade. A transportation web of roads and railways, canals and rivers now linked the various parts of the country in a national market." The key to the whole economic transformation was the new system of transportation. Without it, none of these changes could have occurred. Professors Carman, Syrett, and Wishy wrote: "The great growth of American agriculture and industry after 1815 was made possible in large part by the expansion of the nation's transportation system." This borders on circular reasoning since economic growth further strengthened the demands for new transportation, or "internal improvements." But the spiraling nature of the internal improvements boom was, in fact, an essential ingredient of its success.

"Boom" may well be an inadequate term for the expansion of American transportation in the early 1800's. Though the first turnpike company had built the Lancaster Pike in Pennsylvania as late as 1793, by 1811 New York had added 1,400 miles of road. Pennsylvania, the pioneer, not to be outdone, chartered 146 turnpike companies by 1821. All the other states had built many miles of road as well. Turnpike companies were formed from New Hampshire to South Carolina. Besides roads, canals were built at phenomenal rates. The Erie Canal, started in 1817 and completed eight years later, was the spearhead of the canal movement. Between 1815 and 1840, more than 3000 miles of inland waterways had been constructed at a cost of \$125 million.

Much of the expansion of roads and canals during this time period was well in excess of immediate needs, and many of the companies (or, in the case of canals, states) went bankrupt or at least lost large sums of money. The construction was triggered by a number of causes, greed, competitive spirit, a "follow-the-leader" mentality, nationalism among them. One explanation is that the expansion of roads and canals was part of America's continuing infatuation with economic growth - an infatuation which began with the colonists who faced a vast continent with resources far beyond their needs and which has continued to the present day. In each historical period, this view holds. The growth ethic takes on whatever form is appropriate, be it rapid settlement (to 1800), westward migration and transportation improvement (1800 - 1870), the development of heavy industry (1870 - 1930), or rapid scientific and technological sophistication (1940 - present). The notable hiatus of the Depression years was one warning that there might be fallacies in the traditional growth wisdom. Today's environmental problems are another. Many responsible persons feel that the age of untrammelled growth has passed.

This activity uses quotations from primary and secondary sources to provoke students to think about the relation the growth ethic had to internal improvements explosion of the 19th century. Besides being a valuable exercise in critical thinking, it reinforces ideas about why canals and roads bloomed, and hopefully can urge students to question some traditional American feelings and attitudes about growth.

Before You Begin

Prepare enough copies of the worksheets for each student to have one. This activity should take place after the necessary background on westward expansion and internal improvements has been provided.

Words To Know

assumption, value judgment, primary and secondary source, fact, opinion, growth ethic, internal improvements.

ACTIVITY

1. Remind the students of the distinction between fact and opinion.
2. Explain that most statements of fact, and nearly all statements of opinion, depend on assumptions which may or may not be included in the statement. These assumptions are often value judgments. Elicit definitions of assumptions and value judgments from the class. Provide examples:
Neil says, "It is a sunny day." This is a statement of fact with no apparent assumptions. When he continues, "It will be sunny tomorrow," he is voicing an opinion based on the assumption that the weather will not change in one day.
Susan says, "I would like it if the class had ten more minutes of recess." She is expressing an opinion based on her value judgment that recess is good. When she says, "The class would like to have ten more minutes of recess," her opinion is based on the further assumption that the rest of the class share this value judgment.
3. Hand out the worksheets, explaining that the class is going to consider statements about internal improvements and find the underlying assumptions. Point out that some of the statements were written by active participants in the original debate over internal improvements, while some were written by later historians. Explain the difference between primary and secondary sources.
4. Discuss the examples on the sheet with the class. After making sure everyone understands the directions, give the students enough time to complete the worksheets. (NONE for statement # 6)
5. When all students are finished:
 - a. Tally responses for each statement on the fact-opinion, primary-secondary, and value judgment-no value judgment questions.
 - b. For each statement, have several students tell the class the assumptions they found. Compare their assumptions with others of the class and with those given here. Since there is obviously no single correct answer in any case, discuss the differences.
 - c. Discuss the growth ethic and its implications. Possible questions:
 - 1) Do you think there are times when growth might not be desirable?
 - 2) What lasting effects did the road and canal builders have on the environment? (Many of the old turnpikes now are major highways. Some of the canals remain, though few are used or are profitable. A very small number have become recreational facilities. The roads and canals often brought instant prosperity and population growth to towns along their routes. The building and opening of the Erie Canal, for instance, made Buffalo a town of 20,000 people where only fifteen years earlier there had been just two buildings. As the canals became unprofitable, these towns had to seek new economic raisons d'être. Towns springing up along roads soon became dependent on them and their successors, the arterial highways.)
 - 3) Can you think of other examples of planning and development beyond any actual immediate needs? (Students might need help on this one. Depending on your point of view, you might cite the Alaska pipeline, hydroelectric dams, nuclear power plants, or the interstate highway system.)
6. The following are assumptions suggested by the author for the student worksheet.

STATEMENT # ASSUMPTION (V) indicates a value judgment

Example A Trade in another city does not benefit merchants in one's own town.

Example B Rapid and visible growth is a show of vanity. (V)

1. The society's gain from all internal improvements is greater than the cost. (V)

2. General trends may affect specific decisions.

3. More population, wealth and industry are good things. (V)

4. To dump waste into water is to solve, rather than transfer a problem. (V)

5. Plans should be made for growth that is assumed likely, not plans to control rates of growth. (V)

7. For classes which might have difficulty with the questions as they are originally stated, these adapted statements might be useful.

Example A: If we had not built these roads, much of the trade which passes through our towns would have been lost forever to other cities.

Example B: The United States is the most conceited nation on earth. Its growth and confidence blaze out everywhere, all the time.

1. It is obvious that no intelligent person would even doubt the usefulness of these roads and canals.

2. The state did not spend money on internal improvements in order to meet its needs. It spent the money because of fast changes taking place in the whole country. It was a time of the most rapid growth in history.

3. The Committee said that Michigan should use its resources right away. The improvements would bring more immigrants to the state, and more people meant more industry and wealth.

4. The canal changed the way in which the Chicago River flowed. The water, now with wastes dumped in, flowed to the Mississippi River instead of to Lake Michigan. This solved Chicago's sewage problem.

5. Traffic through the Seaport of Chicago will certainly continue to increase.

6. The Connecticut General Assembly, in 1822, gave a license to build and run a canal from Farmington to Colebrook. Like many others in the state, it was never built.

Related Activities

1. Have students map roads and canals of your state or of the nation which were originally built in the time period being considered. What are they on modern maps?

2. Have students evaluate each assumption given here along a scale from "Disagree strongly" to "Agree strongly."

3. Have students write paragraphs or essays about one of the statements explaining reasons for selecting that assumption, and personal reactions to it.

4. You might want to collect everybody's worksheets and post a composite survey or a few on the bulletin board.

Resources

Education for Survival Grade 5, ed. R.W. Grubman, North Jersey Conservation Foundation, 1972, pp 178-185, EEC #A4 (information and activity ideas on internal improvements)

State of Connecticut Department of Environmental Protection, "The Farmington Canal," May, 1976, EEC #PQ20 (good local and field trip material)

The Pageant of America, ed. R.H. Gabriel; March of Commerce, Vol. 4, Yale University Press, 1927, pp. 49-77 (easy to read, well-illustrated background material)

F. Meidell, letter quoted by H. and M. Brady, Ideas and Action in American History, Prentice-Hall, 1977, pp. 207-209, EEC #B216 (primary source on the effects of railroad building)

Keith, H.E., "An Historical Sketch of Internal Improvements in Michigan, 1836-1846", Michigan Political Science Association, 1900, pp. 1-15, available on microfiche (source of many of the ideas stated herein)

A.B. Shields, "Transportation", in "Environmental Curiosity Sampler," ed. V.A. Stehney, Illinois Institute for Environmental Quality, 1974, pp. 91-94, EEC #357 (about Chicago's growth)

Credit

The first quote in "To the Teacher" is from Don E. Fehrenbacher, The Era of Expansion, 1800-1848; John Wiley & Sons, 1969, p. 55

The second quote is from H.J. Carman, H.C. Syrett and B.W. Wishy, A History of the American People, Vol. I; Alfred A. Knopf, 1964, p. 457

The statistical information given comes from the above two sources and H.A.S. Dearborn, Letters on the Internal Improvements and Commerce of the West; H.P. Lewis, 1839, and

J.A. Krout and D.R. Fox, The Completion of Independence, 1790-1830; MacMillan, 1944

The quotations used on the worksheets are credited there. The Bristol quotation is from p. 67 of Krout & Fox.

Notes To Myself

STUDENT PAGE

DIRECTIONS: THERE ARE SIX STATEMENTS ON THESE SHEETS. READ EACH STATEMENT AND ITS SOURCE CAREFULLY. DO THE FOLLOWING:

1. IF THE SENTENCE IS A STATEMENT OF FACT, CIRCLE THE LETTER F BENEATH IT. IF IT IS AN OPINION, CIRCLE THE LETTER O.
2. IF THE SOURCE FROM WHICH THE SENTENCE COMES IS A PRIMARY SOURCE, CIRCLE THE LETTER P FOLLOWING IT. IF THE STATEMENT IS FROM A SECONDARY SOURCE, CIRCLE THE LETTER S.
3. IN THE SPACE LABELED ASSUMPTION, WRITE DOWN ANY ASSUMPTION(S) YOU THINK ARE THE HIDDEN BASIS(ES) OF THAT STATEMENT. THIS MAY BE ANY OTHER SENTENCE WHICH, IF FALSE, WOULD MAKE THE STATEMENT ON THE SHEET FALSE. IF THE ASSUMPTION YOU WRITE DOWN IS A VALUE JUDGMENT, WRITE (V) AFTER IT. IF YOU DO NOT THINK THERE ARE ANY HIDDEN ASSUMPTIONS, WRITE NONE. DO THE FOLLOWING EXAMPLES WITH YOUR TEACHER:

EXAMPLE A:

STATEMENT: "Had our efforts to establish a system of internal improvements been defeated, a large portion of the extensive trade which we have already secured, and which we shall secure, would fall to New York and Baltimore, and would be irrecoverably lost to rival cities."

SOURCE: Mathew Carey, A Brief View of the System of Internal Improvements of the State of Pennsylvania; J. Harding, publisher, 1834, p.iii

F O P S

ASSUMPTION: Trade in another city does not benefit merchants in one's own town.

EXAMPLE B:

STATEMENT: "The national vanity of the United States surpasses that of any other country. It blazes out everywhere, and on all occasions."

SOURCE: J. Bristol, The Resources of the United States of America, 1818, later reprinted.

F O P S

ASSUMPTION: _____

STUDENT PAGE, CONT'D.

EXERCISE 1:

STATEMENT: "It may, I presume, be taken for granted that there is scarcely a person in the state, of ever so moderate an intellect, who entertains any doubt of the utility of these internal improvements."

SOURCE: Mathew Carey, A Brief View of the System of Internal Improvements of the State of Pennsylvania; J. Harding, publisher, 1834, p. iii

F O P S

ASSUMPTION: _____

EXERCISE 2:

STATEMENT: "The legislators were influenced, not by the immediate needs of the state, but by the rapid changes taking place in the whole country. Perhaps at no time in the history of the world has a nation passed through just such a period of rapid growth."

SOURCE: Hanna Keith, "An Historical Sketch of Internal Improvements in Michigan, 1836-1846," 1900, p. 10

F O P S

ASSUMPTION: _____

EXERCISE 3:

STATEMENT: "The Committee gave reasons why Michigan should take advantage at once of her position and resources. Improvements would bring the immigrant to the state, and increase in population would increase industry, the only source of wealth."

SOURCE: Hanna Keith, as above, p. 4

F O P S

ASSUMPTION: _____

STUDENT PAGE, CONT'D

EXERCISE 4:

STATEMENT: "This canal reversed the flow of the Chicago River. Instead of emptying into Lake Michigan, the river carrying sewage flowed to the Mississippi River. The moving water diluted and purified the sewage as it flowed through the canal and river systems. While this solved Chicago's sewage problem, neighboring states objected to the loss of water from the Lake."

SOURCE: A.B. Shields, "Transportation," 1974, pp. 91-92

F O P S

ASSUMPTION: _____

EXERCISE 5:

STATEMENT: "Traffic handled by the Seaport of Chicago will undoubtedly continue to increase."

SOURCE: A.B. Shields, as above, p. 93

F O P S

ASSUMPTION: _____

EXERCISE 6:

STATEMENT: "The Connecticut General Assembly [in 1822] granted a charter to construct and operate a canal from New Haven to the Massachusetts State line, as well as a secondary canal from Farmington to Colebrook. This second canal, as well as many others in Connecticut, was never built."

SOURCE: Department of Environmental Protection, "The Farmington Canal," 1976, p. 3

F O P S

ASSUMPTION: _____

One-Breath Poems

Curriculum Topic

LANGUAGE ARTS
FAR EAST

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL ETHIC

Grade Level(s)

7 - 8

Site

Quiet outdoors

Skills

Reading, listening, observing,
creative writing

Author

Pat Perrella

Objective

Students will be able to:

1. compose a haiku poem,
2. compare the nature poetry of an American poet to that of an Oriental poet.

To The Teacher

A haiku is a short, non-rhyming poem originating in ancient Japan. The poem is three lines. The first line is five syllables, the second line seven, and the last line five syllables. In haiku poetry, the author captures in a few words a moment, a feeling or an object. The subject of haiku is almost always nature, especially the seasons. One Japanese poet describes haiku as a "one-breath poem," as the poem consists of only as many words as can easily be spoken in one breath.

In this activity, students will see how haiku reflects the Japanese concept of man's relationship with nature. To the traditional Japanese, a person's place in the natural world is not one of opposition but of integration. This can be contrasted with the Western concept of humanity opposed to and seeking to subdue nature.

Before You Begin

Materials: paper, pencils, something portable and stable on which to write, dittos of Poem Sheet, dittos of Reflection Sheet.

Words To Know

haiku

576

ACTIVITY

1. Students will read the sample Poem Sheet.
2. Discuss the reactions of the students to the sample haiku. Then discuss the haiku form. How does the choice of words reflect the poet's feeling toward nature?
3. Students will go to an outdoor setting, where they will sit quietly, apart from each other, for five minutes, all the while sensing nature with eyes, nose and ears. (They may reread the Poem Sheet in this setting.)
4. Based on this brief moment outdoors, students will compose a haiku.
5. Back in the classroom, have students voluntarily read a haiku poem to the class.
6. Students will then work on Reflection Sheets.

Related Activities

Plan similar activities using samples of American Indian or Eskimo poetry, again emphasizing how the poem reflects the poets' feelings toward his environment.

Resources

A Few Flies and I, Haiku by Issa, ed. J. Merrill and R. Silbert, Pantheon Books, 1969

Cricket Songs, tr. Behn; Harcourt, Brace and World, 1964

Thoreau, H.D., Walden or Life in the Woods, Doubleday, 1960, p 75, 112

Notes To Myself



STUDENT PAGE

BUTTERFLY, THESE WORDS
FROM MY BRUSH ARE NOT FLOWERS
ONLY THEIR SHADOWS



ONE MAN AND ONE FLY
BUZZING ALONE TOGETHER
IN A SUNNY ROOM

MY HORSE CLIP-CLOPPING
OVER A FIELD...OH HO. I'M
PART OF THE PICTURE

SINCE MY HOUSE BURNED DOWN,
I NOW OWN A BETTER VIEW
OF THE RISING MOON.

ALL THE RAINS OF JUNE
AND ONE EVENING, SECRETLY
THROUGH THE PINES, THE MOON

WELL! HELLO DOWN THERE,
FRIEND SNAIL! WHEN DID YOU ARRIVE
IN SUCH A HURRY?

STUDENT PAGE

REFLECTION SHEET

1. WHICH OF THE HAIKU POEMS DO YOU LIKE BEST? WHY?
2. THESE SHORT POEMS CONVEY THE POETS' FEELINGS ABOUT NATURE. DESCRIBE THOSE FEELINGS.
3. HOW DO YOU THINK THESE JAPANESE POETS WOULD DESCRIBE MAN'S PLACE IN NATURE?
4. READ A NATURE POEM BY AN AMERICAN POET (E.G., EMILY DICKINSON, ROBERT FROST, WALT WHITMAN). WHAT ATTITUDE DOES THE AMERICAN POET HAVE TOWARD NATURE? HOW DOES THE AMERICAN ATTITUDE COMPARE TO THE JAPANESE?
5. ALTHOUGH WE DO HAVE MANY SERIOUS ENVIRONMENTAL PROBLEMS IN AMERICA, MANY AMERICANS HAVE RECOGNIZED THEM AND HAVE CRITICIZED THE ATTITUDE THAT MAN IS HERE TO DOMINATE AND UTILIZE NATURE. SUCH AN AMERICAN CRITIC WAS HENRY DAVID THOREAU (1817 - 1862). HE WROTE:

"Such a delicious evening, when the whole body is one sense, and imbibes delight through every pore. I go and come with a strange liberty in Nature, a part of herself."

COMPARE THESE THOUGHTS FROM THOREAU WITH THESE IDEAS FROM A HAIKU POET:

"The morning wind forever blows, the poem of creation is uninterrupted; but few are the ears that hear it."

Is the Moped a Status Symbol of the Future?

Curriculum Topic

THE FUTURE

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

Adaptable

Site

Classroom

Skills

Recognizing problems,
generating alternate
solutions, brainstorming

Author

Cyndi Walsh

Objective

The student will be able to:

1. distinguish between wants and needs.
2. list the ways advertising media appeals to the public.
3. evaluate the role of advertising in poor environmental management.
4. assess the role of advertising in building proper environmental ethics.

To The Teacher

In the United States at this time there is a great concern for the development of consumer education programs. Necessary critical thinking skills are essential to effective functioning as consumers and citizens. This activity will give students an opportunity to interact positively with their environment, and encourage students to see themselves as responsible critical consumers. The typical TV target audience is between 2 and 11 years old and watches over 20,000 commercials in a year. Students need to be discerning. Current proposals from the Federal Trade Commission entertain the idea of a ban on commercials directed at children under 8 with a penalty of corrective advertising to give the balanced information. Consumer education is becoming a government priority!

Before You Begin

Materials: advertisements from all sorts of media, magazines, newspapers, taped radio and TV commercials.

Words To Know

advertising, status, deception

"I don't care what the ad said, I'm not going to wear it!"



ACTIVITY

Part I

1. Ask students to bring to class advertisements or a description of commercials of products they may want or need in a year's time. (Album ad from newspaper, TV commercial for ten-speed bike, etc.)
2. Place all advertisements together and ask students to separate needs from wants. (essential from non-essential)
3. Discuss what internal and external factors make it difficult to make this judgment.
4. How does advertising influence this judgment?
5. Ask students to write down their last purchase and why they bought it.
 - a. Did an advertisement cause the desire to own the item or did they want it first and then seek out advertisement for information?
 - b. Were they happy with their purchase? Did it live up to the expectations? Was the advertisement accurate?
6. Develop a list of ways in which advertising convinces the consumer that wants are needs. Such as: it appeals to - emotion, logic sense of humor. (Other categories will grow from analysis of ads.)
7. Ask students to categorize the ads they brought to class based on the list. Examples:
 - a. Find a family ad that shows a happy family using the product. (emotional)
 - b. Find a romantic advertisement that insure popularity. (emotional)
 - c. Find a humorous ad with a catchy jingle or phrase. (humorous)
8. Ask students to brainstorm other categories and types of appeals. This part of the activity will insure a critical evaluation of the media.

Part II

1. Group students to brainstorm ways in which the advertising industry might act more constructively in terms of our world problems.
2. Challenge students to find examples of advertisements that promote energy conservation, recycling, etc. (These may be found in business magazines such as Forbes.)
3. How does advertising use peer pressure and status seeking to inspire countless energy using activities and waste. Can it be used to make energy saving and recycling a status symbol of the future?
4. Ask students to envision a time when they may be resentful of an energy wasteful consumer. A flashy car dragster racing up to a gas pump threatens our fuel supply whereas the conservative moped owner might be praised as an American hero.
5. Ask students to brainstorm ways to play up energy saving and recycling (e.g. encourage non-polluting cleaners. Using advertisement methods, develop environmental ads that encourage a purchase of a product because it is not harmful to the environment. Turn a patriotic casue into a status symbol.)

6. Put your campaign into action using tapes posters, etc. Share your ideas with other class members.

Related Activities

1. Debate the following issue:

The staff of the Federal Trade Commission has sent forward proposals to:

- a. ban any advertising to kids under 8.
- b. eliminate advertising of highly sugared products to kids between the ages of 8 and 12.
- c. force advertisers of other sugared foods to pay for corrective advertising to give kids balanced information.

Side I: Many people believe that there is sufficient evidence of deception and unfairness in children's advertising to warrant a rule-making proceeding.

Side II: Advertising business people believe that a ban on advertising will not change children's wants and needs. The ban on cigarette smoking did not influence people to quit smoking.

Ask your class to compromise this dilemma.

2. Have your class create a new product that is environmentally sound. Design a container. Develop a radio and TV campaign to promote this new creation.

3. Write to companies asking them to substantiate their claims in their advertising.

Resources

Advertising Age, February 27, 1978 pp. 51-52.

"Argument Over Advertising to Children", Media Decisions, May, 1978 p. 61 ff.

Credit

Drawing: Cecelia Zych

Notes To Myself

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Forecast for the Year 2000

Curriculum Topic

THE FUTURE

Subject

Social Studies/Science

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

6-8

Site

Classroom

Skills

Analyzing, recognizing problems,
classifying

Author

Thomas J. Kotulski

Objective

The student will be able to:

1. evaluate a series of statements concerning the future.

To The Teacher

This activity is based on a short questionnaire. The items represent typical "forecasts" about the future, its problems and possibilities. It considers key aspects of the Human future - population, food, natural resources, industrial production, consumption values, energy, pollution, war, political identity. The lesson does not call for analysis of these factors; it simply brings them into view.

Another purpose of this activity is to begin creating awareness of the connections between factors, and to transmit information indirectly. For example, students may approve of the forecasts that American income and income in developing nations will each double. But as they ponder these forecasts, they also learn that those incomes are disparate. Or, students may approve of the forecast that developing nations will industrialize successfully, but not approve of the environmental pollution that might result. This conflict sets the stage for discussion of trade-off's and possible solutions to the conflicts.

Before You Begin

Preparation: Prepare the questionnaire for the class. Here is background on certain items on the questionnaire to help the discussion:

- Item #1 - The world population in 2000 AD will very likely be 6,000 million .
- Item #2 - U.S. population is increasing at a rate of less than 1% annually.
- Item #3 - Famines are present in sub-Saharan Africa. Pollution of parts of Asia is extremely likely to outrun food supplies especially if weather reduces crops in major food exporters such as U.S., Canada, the Soviet Union and Australia. Another important factor will be the capacity of nations like India to produce and use fertilizer. Present inadequacies in fertilizer utilization may be solved by 2000 AD.
- Item #4 - Per capita income is figured by dividing GNP by the number of people. In the U.S., if you shared equally the total value of goods and services, every man, woman and child would have a \$6,000 worth. This does not mean that \$6,000 is the average income of a worker. U.S. economic growth has been averaging about 3% annually. With a population growth of .6% annually it means a net growth of 2.6% so barring a major depression, income will double by the year 2000.
- Item #5 & 6 Probably will occur.
- Item #7 - A very real possibility.
- Item #8 - The book, Limits To Growth (pp 56-59), states that the life of known global reserves is: petroleum - 31 yrs., coal - 2,300 yrs., copper - 36 yrs., natural gas - 38 yrs., tin - 17 yrs., iron - 240 yrs., mercury - 13 yrs. Note that as consumption of these resources varies and new reserves are discovered, these figures can not be considered as exact forecasts.
- Item #9 - Proponents of nuclear power favor this. Opponents hope solar power and other alternatives are developed.
- Item #10-18 Debatable answers.

Words To Know

per capita income, GNP, developing countries, industrialize-developed countries, non-renewable, material possessions, nationalistic.

ACTIVITY

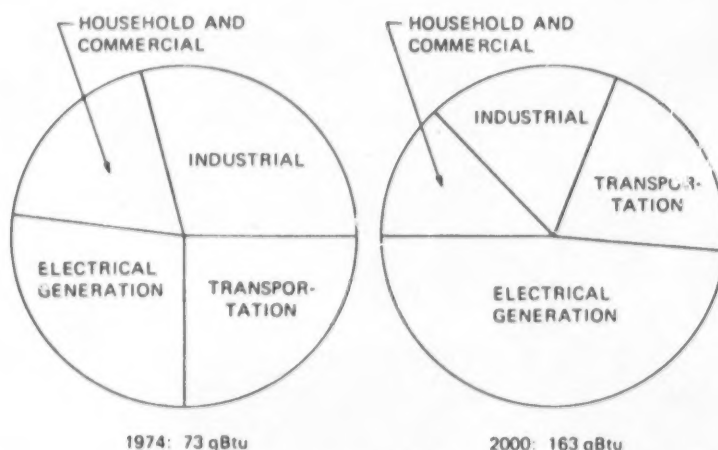
1. Distribute and administer the questionnaire.
2. Follow up with a discussion. In particular, focus on contradictory answers and desires. Attempt to brainstorm solutions and compromises.

Resources

Turk, Turk, Wittes, Wittes, Environmental Science, Saunders, 1977.

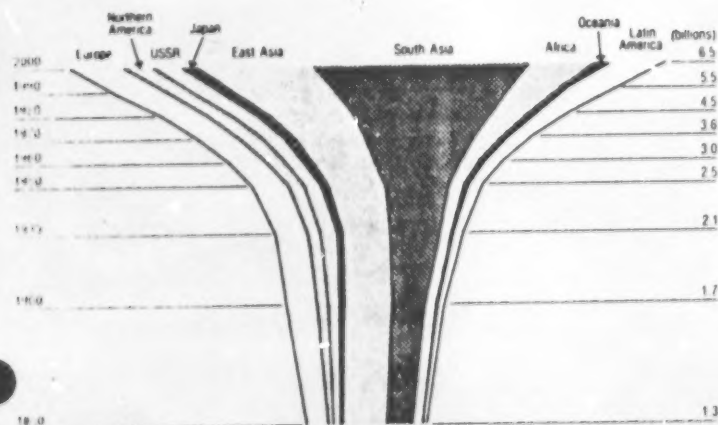
"A Study Guide to Population and The American Future," The Population Reference Bureau, Inc. EEC #126.6, 1973, p3-18, Newark, NJ, Board of Education.

Notes To Myself



U.S. energy consumption in quadrillion British thermal units: 1974 and 2000 (projected). Figure assumes that synthetic fuels are distributed among the consuming sectors in the same ratios as their non-synthetic counterparts (based on estimates from U.S. Department of the Interior)

Estimated Growth and Regional Distribution of the World's Population, 1850-2000¹



¹ Based on estimates of 1963 fertility levels

Source: U.S. Secretariat, Population Division, and J.A. Dillard, "The Modern Expansion of the World's Population," *Proceedings of the American Philosophical Society*, Vol. 111, No. 3, May 1967, p. 311. U.S. Fund for Population Activities, WPP Bulletin, No. 1, May 1973.

STUDENT PAGE

Forecast for the Year 2000

Directions: Each statement below describes a possible condition in the year 2000. For each statement, mark in the left-hand column with a (✓) whether you approve or disapprove. Make a mark if it seems clear what the answer is. In the right-hand column, check whether you think it will, or will not happen.

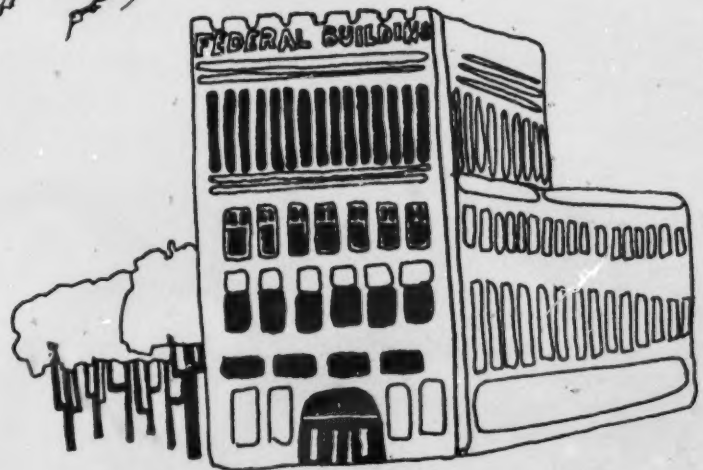
Approve/Disapprove		Will Not Will Happen/Happen
_____	1. Present world population now at 4 billion; will reach 6 billion.	_____
_____	2. The U.S. population of 220 million will increase slower than world population and will not be more than 250 million.	_____
_____	3. Population will increase faster than food production and starvation will cause many to die of hunger.	_____
_____	4. American per capita income will have doubled from \$6,000 to \$12,000.	_____
_____	5. Per capita income of developing nations will have doubled from \$300 to \$600.	_____
_____	6. Many developing countries will have industrialized.	_____
_____	7. Air and water pollution levels will be high because developing nations can't afford pollution controls.	_____
_____	8. Global reserves of many non-renewable resources will be almost exhausted.	_____
_____	9. Nuclear power will supply 1/3 of U.S. energy needs.	_____
_____	10. There will be serious accidents involving radioactive materials.	_____
_____	11. Almost all nations will have nuclear weapons.	_____
_____	12. Advertising, easy credit, anything that stimulates resource consumption will be illegal in the U.S.	_____
_____	13. In the U.S., material possessions and financial success will not be used to decide a person's importance.	_____
_____	14. Industrialized countries will be less nationalistic and more worldly.	_____
_____	15. There may be small wars, but not a large war involving large countries.	_____
_____	16. Pollution, food and energy problems will be solved by science.	_____

Approve/Disapprove

Will Not
Will Happen/Happen

17. People will be as concerned about
the world's welfare as they are about
the welfare of their fellow citizens.

18. People will be as concerned for the
future as they are of the present.



Puppies, Pooches & Hounds

Curriculum Topic

HEALTH, URBAN STUDIES -
People in the city have special
problems and responsibilities.

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL ETHICS - Each indi-
vidual must develop a sense of
individual and collective respon-
sibility for the maintenance and
improvement of the environment.

Grade Level(s)

6 - 9

Skills

Brainstorming
Recognizing problems
Identifying alternatives
Citizenship skills

Site

Classroom

Author

Maryann Cronin Horgan

Objective

Students will be able to:

1. examine and express their feelings about dogs
2. identify the special responsibilities of dog owners and the problem of dog litter
3. make "pooper-scoopers" to reinforce their commitment to help solve the litter problem.

To The Teacher

Most children relate affectionately to pets, especially dogs. However, any residential setting presents special problems and civic responsibilities to dog owners. The brainstorming and values clarification activities will generate discussion and motivation for possible further action. It will be the teacher's task to provide facts where needed during discussions and to temper any over-zealous action against dog-owners. Points of consideration for discussions: 1) there is a chemical in dog urine and feces that kills grass and trees; 2) flies are attracted to the dog litter and they carry disease; 3) toxicariasis is a disease afflicting young children caused by dog droppings. Another concept to understand is that in the country, the dog litter can return to the soil through normal decomposition, but in the city, the droppings do not decompose into the concrete.

Check into local laws concerning the responsibilities of dog owners in your town - "leash laws," dogs in parks, "curbing" laws. If a heated controversy develops, the students should realize that these laws are not against dog ownership but for human protection.

Inspiration for making "pooper-scoopers" can be found in a free pamphlet from the Environmental Protection Administration, Office of Public Information, Municipal Building, New York, New York 10007. The pamphlet is called "Dog Owners Guide to Scooping." Many pet stores now carry commercial scoopers also.

Before You Begin

Prepare copies of values clarification sheet (Man's Best Friend) for the classmembers.

Words To Know

leash law, toxicariasis, sanitation, curbing



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ACTIVITY

1. The class will first brainstorm ideas under two topics: A Dog is Man's Best Friend and Dogs Cause Problems.
2. Students then work on the values clarification sheet alone and share their results in small groups. A group spokesman should then report to the rest of the class on how the group feels dog owners should act in order to be good neighbors.
3. Sponsor a class contest to make a "Pooper-Scooper" as a home project.

Related Activities

1. Have the dog warden come to speak in class.
2. Check local pet stores to see if they sell pooper-scoopers. Ask them to carry a supply if they don't already.
3. Investigate how the sanitation department cleans your streets.
4. Collect soil samples from a park and examine under a microscope to find toxicariasis worms. (This activity requires CAUTION!)

Credit

It's Your Environment, ed. Sherry Koehler, Charles Scribner & Sons,
New York, 1976 EEC #818

Notes To Myself

STUDENT PAGE

DIRECTIONS: RATE THESE STATEMENTS ON A SCALE OF 1 TO 5. TO CIRCLE 1 MEANS THAT YOU DISAGREE STRONGLY WITH THE STATEMENT. TO CIRCLE 5 MEANS THAT YOU AGREE STRONGLY WITH THE STATEMENT.

- | | | | | | |
|--|---|---|---|---|---|
| 1. A dog is man's best friend. | 1 | 2 | 3 | 4 | 5 |
| 2. Dogs cause problems for man. | 1 | 2 | 3 | 4 | 5 |
| 3. Dog litter is a big problem. | 1 | 2 | 3 | 4 | 5 |
| 4. Our city streets are one big dog toilet. | 1 | 2 | 3 | 4 | 5 |
| 5. There is nothing we can do about the problem of dog litter. | 1 | 2 | 3 | 4 | 5 |
| 6. Dogs should not be allowed in the city. | 1 | 2 | 3 | 4 | 5 |
| 7. Dog urine harms plants. | 1 | 2 | 3 | 4 | 5 |
| 8. Dogs should not go into stores. | 1 | 2 | 3 | 4 | 5 |
| 9. Dog litter could cause disease. | 1 | 2 | 3 | 4 | 5 |
| 10. Dogs should not be allowed in parks. | 1 | 2 | 3 | 4 | 5 |
| 11. Curbing your dog will solve the dog litter problem. | 1 | 2 | 3 | 4 | 5 |
| 12. Dog owners should pick up their dog's litter. | 1 | 2 | 3 | 4 | 5 |
| 13. Dog owners should get tickets if they don't clean up after their dogs. | 1 | 2 | 3 | 4 | 5 |
| 14. Dogs should only live in houses with backyards. | 1 | 2 | 3 | 4 | 5 |
| 15. The city should make dog owners pay a high tax for their dogs (dog license). | 1 | 2 | 3 | 4 | 5 |

Is the Environment a Cause?

Curriculum Topic

CITIZENSHIP/CIVICS

Subject

Language Arts
Social Studies

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

7,8

Site

Classroom

Skills

Reading comprehension
Communicating information

Author

Carla McGeeney

Objective

The students will be able to:

1. discuss and evaluate, critically, environmental literature and organizations.

To The Teacher

Friends of the Earth is a non-profit membership organization committed to the preservation, restoration and rational use of the earth. They describe themselves as "streamlined for aggressive political and legislative activity...neither tax-deductible nor tax-exempt in order to fight without restrictions."

The article attached to this activity is a poster distributed by Friends of the Earth. The object of this lesson is to present to students a typical piece of environmental literature to encourage their critical abilities. The ability to evaluate and avoid superficial environmental causes is crucial to developing in students the environmental literacy necessary to tackle complex problems.

ACTIVITY

1. Have students read aloud the article "An Open Letter to the People of a Dying Planet."
2. As a class, brainstorm three lists:
 - a. The first list will include important issues raised in the article. (conservation of resources, hazards of food, pesticides, etc.)
 - b. The second list compiled by the class will be the opinions of "Friends of the Earth" regarding each of these crucial issues.
 - c. Finally, the last list will include the facts, figures and rationalizations used to support each of these issues deemed "crucial/critical" on the one hand, and opinion, on the other.
3. Each student in the class can then choose one issue from the article to research. The students should review literature both supportive and opposing. Their findings can be presented to the class.
4. Another discussion should follow these presentations. During the discussion the class can consider the quality and purpose of the "Friends of the Earth" poster. They should be expected to call upon their experience and learning in critical reading to assess the claims made in the poster.

Related Activities

1. Collect environmental slogans and evaluate their content value.
2. Contact a number of environmental organizations to determine their purposes and the quality of their work.

Resources

- J. G. Roloff and R. C. Wylder, There Is No Away; Glencoe Press, 1971, EEC #B174



An open letter to the people of a dying planet.

For years, experts have pleaded with you to conserve your resources. Ecologists have warned that your fumes and bulldozers and wastes and chemicals have already tipped the balance of nature against you. And still, the vast majority of you can't, or won't, comprehend.

Don't you realize that most of your food is hazardous to your health? That *you eat* the pesticides they spray on crops, *you eat* the drugs they feed your cattle, *you eat* the chemicals they use to preserve and flavor your food.

Don't you realize that most of your "disposables," such as plastic containers, aluminum cans and wax cartons, are just as dangerous as auto exhaust? (A city incinerator just changes them into poisonous smoke.)

Don't you realize that an entire ocean *can* be polluted? (Navigators actually include great seas of sewage in their charts.)

That nature actually *needs* the millions of animals you slaughter each year for clothing? (Remember, your sealskin coat was once a seal.)

That rampant and unlimited consumption eventually consumes *you*? . . .

[Take] a long look at what you're doing to destroy yourself. At what you wear, what you eat, what you waste and what you put up with.

Only your own living and buying habits will reclaim this planet.

Only your letters and votes will force politicians to place life over lobbies.

Only your buying power will convince industry that a dead planet is bad for business. . . .

There may be no time *but* the present.

**Friends of the Earth
30 East 42nd Street
New York, New York 10017**

Stay Alive at 55 (MPH)

Curriculum Topic

CITIZENSHIP

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

8

Site

Classroom

Skills

Gathering data, testing a hypothesis, graphing

Author

Robert Slie

Objective

The students will be able to:

1. test hypotheses through the construction and interpretation of graphs.

To The Teacher

This lesson emphasizes the discovery method of learning. Through constructing and interpreting graphs and answering questions, students are led through the steps of investigating an hypothesis: The 55 MPH Speed Limit saves lives.

Before You Begin

Materials: one sheet of graph paper for each student, colored pencils, optional: tape recording of CB conversation.

Preparation: Prepare (duplicate) copies of the Student Pages for each student in the class.

Words To Know

bar graph, line graph, totalities, conclusion, axis, tabulations,

ACTIVITY

1. A special feature CB radio conversation may be used to introduce this lesson. Read it aloud or make copies available for the class to read. Discuss the rapid growth of CB radios. Why do people like to talk to others in this way? Why do they use a code?

Another way in which to begin this lesson is to present a tape recording of a CB conversation. Allow students a few minutes to listen to it. Then plunge at once into the subject of saving lives as a good citizen's responsibility. The motivating question might be: How can people protect themselves from themselves? A lively debate can result, and, if properly directed, can lead to a consideration of good safety rules for drivers.

A third approach to this lesson on saving lives might be through a discussion of the special terms in the CB Conversation. This approach can lead to a direct approach in graph-constructing part of the lesson.

Place the following question on the board: Do you think the increase in the number of people using CB radios has made law enforcement more difficult?

This question refers to the fact that if people know where the police are, they tend to avoid that area or to slow down. When they have passed this area, however, they speed up again. CB information has made law enforcement more difficult.

Play back the CB Conversation, or have students re-read it. Ask: Can you think of a way the CB information might help save lives?

Students can offer a variety of opinions at this time. Draw from their backgrounds examples of driving habits they have seen, such as slowing down in radar areas. Slowing down, for whatever reason, lowers the chance of fatal accidents.

2. Instruct the students to construct a bar graph that will show the number of vehicle miles traveled on American highways in the years 1973, 1974 and 1975 using the data on the table. Ask them to put a title on their graphs.

3. Ask each student to prepare a line graph according to instructions in Part II of Student Pages. Remind them that this is a line graph. Using three different colored pencils will help them.

4. When students have completed their graphs, use the following questions to discuss conclusions that can be made from graph:

- a. What conclusions can you draw about the years 1974 and 1975? (The range in the numbers of deaths in 1974 and 1975 is very close.)
- b. What conclusions can you draw when you compare the numbers of deaths in 1973, 1974 and 1975? (There were significantly more deaths in 1973 than in the years following.)

5. Using Both Graphs, ask the following questions:

- a. What relationship do you see between the total number of miles driven and the number of highway deaths?
(The graphs show that while miles driven increased again in 1975, the death rate remained quite stable.)
- b. How does the information on both graphs help to support the conclusion made by the National Highway Safety Administration that "lowering the speed limit on the nation's highways saves lives?"
(The number of traffic deaths dropped in 1974, in part, because there were fewer miles driven. The graphs show that the miles driven increased again in 1975, but the death rate stayed down. This must have been caused by the lowered speed limit.)

Related Activities

1. Prepare another problem-solving lesson which deals with the effect of the 55 MPH speed limit on energy savings.

Credit

This activity is excerpted largely from "How a Bill Becomes a Law to Conserve Energy", Interdisciplinary Student/Teacher Materials in Energy, the Environment, and the Economy, prepared for the U.S. Dept. of Energy by National Science Teachers Association, 1977.

Notes To Myself



STUDENT PAGE

Include if CB is used:

Breaker	the speaker wants to talk to you on channel 19
Got your ears on?	are you tuned in to channel 19?
Going to put the pedal down	preparing to travel at a fast rate
Smokey	a state trooper or policeman
Taking pictures and giving out green stamps	using radar and giving tickets or fines
What's your Ten-Twenty?	Where are you?
Ten-four	I understand
Four-roger	Okay. Yes.

The Right to Live

Curriculum Topic

CITIZENSHIP AND CIVICS

Subject

Social Studies

Environmental Topic

ENVIROMENTAL ETHICS

Grade Level(s)

8

Site

Classroom

Skills

Citizenship skills,
recognizing problems,
choosing freely,
writing

Author

Robert Slie

Objective

The student will be able to:

1. identify ten (10) enviromental rights that could be listed as an Environmental Bill of Rights,
2. write them up using the format of the Constitution's Bill of Rights,
3. to distinguish between a right and a responsibility.

To The Teacher

The teacher may wish to use this activity after studying the Bill of Rights as part of the United States Constitution

Words To Know

inalienable, liberty, pursuit of happiness over population, environment, citizenship, constitution

ACTIVITY

1. Review the basic concepts included in the constitutional "Bill of Rights" emphasizing the inalienable rights that all citizens are born with and are guaranteed by law. Discuss the following with the students:
 - a. What is a right?
 - b. What is a responsibility?
 - c. What is the difference between a right and a responsibility?
2. Direct students to read carefully the first ten amendments to the Federal Constitution. Discuss with the class the long and difficult task of writing these statements.
3. Generate a discussion involving the quality of the environment and every citizen's right to enjoy it.
4. Compile a list of environmental problems that should be corrected to improve the quality of life.
5. Provide students with a handout listing a number of environmental responsibilities.
 - a. Why should all individuals be responsible for the environment?
 - b. Do all individuals also have rights regarding the quality of their environment? Explain.
6. Ask students to write a list of rights pertaining to the quality of our environment. Copy these on the chalkboard or an overhead projector transparency and have students analyze and discuss in relation to the following:
 - a. The Constitution guarantees to each individual "life, liberty, and the pursuit of happiness." What does "life" mean in this statement? How does this relate to environmental problems?
 - b. Categorize each statement as a right or a responsibility.
 - c. How do the concepts of right and responsibility overlap in dealing with the environment? Do they correspond? Explain.
 - d. Is each statement reasonable both as a private right and as a right of an organization or corporation? Why, or why not?
 - e. Why is it difficult to be specific in dealing with individual rights?
 - f. Do any of the statements suggest infringement on the right(s) of other individuals in any way? Which ones, and how do they?
 - g. Why is there a need for individual concern and action with regard to environmental improvement?
Vote to retain or eliminate each statement of "environmental rights."

Vote to retain or eliminate each statement of "environmental rights."

7. Provide the students with a typed, revised list of their "environment bill of rights," and review the difficulties encountered in the democratic procedure employed in preparing the list. Two samples of environmental bill of rights follow:

ENVIRONMENTAL BILL OF RIGHTS

Every individual shall have the inalienable right to:

- breathe clean, unpolluted air
- drink clean, unpolluted water
- receive an ample amount of food
- have adequate sources of energy for life
- have access to natural land areas
- maintain wildlife in their natural areas
- live on an adequate piece of land
- express concern regarding an environmental problem

MANKIND'S INALIENABLE RIGHTS

Paul R. Ehrlich
from The Population Bomb

1. The right to limit our families.
2. The right to eat.
3. The right to eat meat.
4. The right to drink pure water.
5. The right to live uncrowded.
6. The right to avoid regimentation.
7. The right to hunt and fish.
8. The right to view natural beauty.
9. The right to breathe clean air.
10. The right to silence.
11. The right to avoid pesticide poisoning.
12. The right to be free of thermonuclear war.
13. The right to educate our children.
14. The right to have grandchildren.
15. The right to have great-grandchildren.

8. Discussion questions:

- a. Compare the "environmental right" to the basic rights and freedoms listed in the Constitution's Bill of Rights.
- b. Is there a need to modify the Constitution to include provisions for environmental rights? Where in the constitution could such provisions be included?

Related Activities

1. The teacher could ask students to write amendments to the Constitution dealing with environmental problems. A role-playing activity could revolve around the amendment process.
2. Survey a number of the students in the school. Will they "accept" your environmental bill of rights? Why, or why not?
3. Prepare posters and/or cartoons depicting environmental rights and responsibilities for display in the school.

Resources

DeBell, Garret, ed., The Environmental Handbook, Ballantine Books, 1970, p. 233.

Gross, Richard, and Vanzà Devereaux, Civics in Action, Field Ed. Publ. 1966.

Credit

Ehrlich, Paul R., "Mankind's Inalienable Rights", from The Population Bomb, NY Ballantine Press, 1968.

Notes To Myself

What is Your Job?

Curriculum Topic

CAREER AWARENESS

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

6

Site

Home and School

Skills

Locating information, using
information for a purpose,
communicating information

Author

Carla McGeeney

Objective

The student will be able to:

1. distinguish between environmentally related jobs and those which are not.
2. discuss critically the aims and objectives of environmentally related jobs.

To The Teacher

In 1968 the U.S. employed 600,000 people at the professional or para-professional levels in environmental management. It is predicted that by 1980 1.2 million will be employed. The following is a partial list of environmentally related careers:

health scientists
sanitation
public health
conservationist
fisheries
soil conservationist
civil engineer
urban planner

environmental engineer
health physicist
ecologist
agricultural engineer
forester
aquarium management
landscape architect

There are a number of routes for persons to choose if they want to go into an environmentally related field. There are two year plans or four year curricula.

Two year options include:

1. community college
2. agriculture and natural resource program
3. environmental technicians and aides
4. environmental control technology

Four year curricula include:

1. new environmental colleges
2. environmental programs at major universities
3. post graduate education

Lawyers, electricians, teachers, and other professionals are in direct contact with environmental issues also.

Before You Begin

Materials: scissors, national or city newspapers, science magazines, glue, posterboard, magic markers, Student Data Sheet

The actual cutting up of the science magazines and newspapers and be assigned as homework or can be done in the class with discussion at the same time.

Words To Know

conservationist, ecologist, urban planner



ACTIVITY

1. Have students discuss in class jobs that they would consider to be environmentally related.
2. When they have some idea of job types have them look through the "Help Wanted" ads in a large newspaper or back of science magazines. Have them cut out or copy any ads they feel are environmentally related.
3. When all ads have been cut out, discuss in the class why these jobs are environmentally related. Discuss the qualifications of a person hired for this job.
4. Discuss the job requirements, pay scale, and working conditions. This information may have to be collected outside the classroom on an individual basis.
5. Have the students make a poster with the jobs they have cut out. Display the poster where other students can see it.

Related Activities

1. Have students decide on some jobs they would like to have done. Have them write their own ads. Each student should write one ad.
2. Have students exchange ads. See if one student can interpret the ad of the other student as far as job description.
3. Have students fill out job application forms for the youth conservation corps in their communities.

Resources

Fanning, Odom, Opportunities in Environmental Careers, Vocational Guidance Manual, Inc., Louisville, 1975.

Outdoor Classroom, U.S. Bureau of Sport Fisheries and Wildlife Environmental Science Center, EEC #1089.

Notes To Myself

STUDENT PAGE

DATA SHEET

CAREERS

NAMES _____

DATE _____

SITE _____ JOB TITLE _____

1. CAREER DESCRIPTION _____

2. RELATED FIELDS _____

3. WORKING CONDITIONS _____

4. ABILITIES AND TRAINING _____

5. SATISFACTIONS _____

6. ATTITUDES _____

Should Doughnuts be Allowed in School?

Curriculum Topic

NUTRITION AND DRUGS

Subject

Social Studies

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

Adaptable

Skills

Brainstorming, recognizing problems, generating alternate solutions

Site

Classroom

Author

Cyndi Walsh

Objective

The student will be able to:

1. discuss the beneficial aspects of a nutritious, sensible breakfast for school age students.
2. demonstrate an awareness of the responsibility of citizens to develop and change policy that effects the well-being of all Americans.

To The Teacher

As future citizens, students of today will be faced with decisions that will have a direct impact on the quality of life. The following decision-making activity will give practice in such a process and will reinforce consideration of all consequences. This aspect of analysis is a vital part of decision-making for the citizen, consumer and voter. Presented in this activity is a very real priority concern for the government.

Background information on the use of the continuum, alternative search, and a consequence search used in this activity follows:

- a. Continuum: the teacher and the students determine two polar positions on an issue. The positions are placed at the opposite ends of the line, and a series of points are marked along the continuum. The teacher asks the students to indicate their position on an issue, briefly describing their assessment and rationale. (This can be a written assignment.)
- b. Alternative search: the teacher gives a value-laden problem such as the super doughnut story, and asks students to brainstorm alternatives. In small groups students combine answers add other solutions and decide on the top three solutions. These three solutions are then rank ordered.
- c. Consequence search: after the three top solutions are chosen, each group member is asked to brainstorm resulting consequences of each answer. Groups report to the class.

All of these strategies are included in the following activity. The activity is self-directing and the teacher need only facilitate the grouping, allocate time and answer general questions.

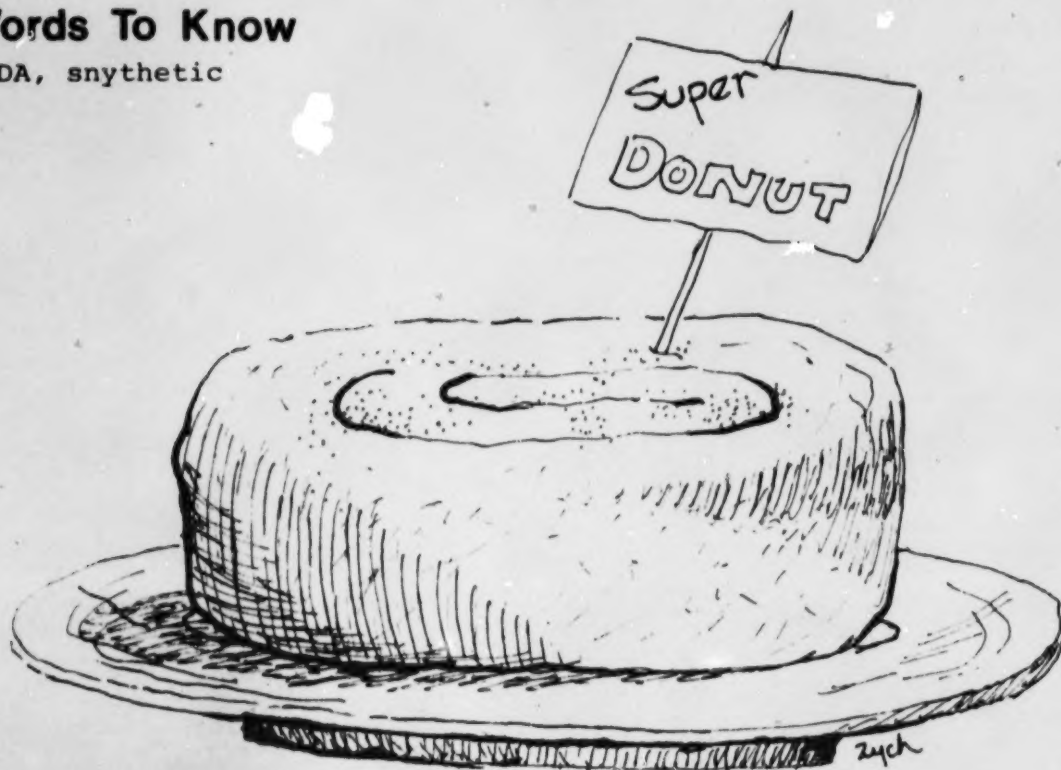
Before You Begin

Materials: Students will need pencils.

Preparation: Duplicate enough copies of the problem description and student direction page for entire class.

Words To Know

USDA, snythetic



ACTIVITY

1. Group students.
2. Pass out the problem description page.
3. Read problem orally.
4. Distribute direction page.
5. Instruct groups to follow the directions to solve the problem.
6. Debriefing session; Sharing of group's decisions.

Related Activities

1. Nutrition activities may be encouraged by the group interaction; breakfast checklist, cereal analysis for nutrition and cost per unit.
2. Write letters to the USDA concerning the proposed ban.
3. Research inner-city school breakfast policies.

Resources

"Does the USDA Have A Whole In the Head?", Vegetarian Times, April, 1978, p. 15.

Credit

Drawing: Cecelia Zych

Notes To Myself

STUDENT PAGE

WHAT'S TO BE DONE?

ON ANY GIVEN DAY 203,000 SCHOOL CHILDREN WILL EAT A "SUPER DOUGHNUT" AND A GLASS OF MILK FOR BREAKFAST. THE SUPER DOUGHNUT IS REALLY A SWEETROLL MADE OF WHITE FLOUR, SUGAR, AND SHORTENING WITH AN EXTRA DOSE OF SYNTHETIC VITAMINS WHICH WILL PROVIDE $\frac{1}{4}$ OF THE CHILD'S RDA OF KNOWN VITAMINS. MOST SCHOOL SYSTEM'S PURCHASE THEM FROM WONDER-BREAD OR KEEBLER BAKERIES.

THESE BREAKFAST BARS OR FORMULATED GRAIN FRUIT PRODUCTS ARE A NEW PART OF THE FEDERAL SCHOOL BREAKFAST PROGRAM. SINCE THEIR INTRODUCTION IN 1973, THE BREAKFAST BARS HAVE BEEN UNDER ATTACK BY PARENTS, TEACHERS AND NUTRITIONISTS. RECENTLY, THE USDA HAS JOINED THE CRITICISM ARGUING THAT THE TREAT DOES NOT INSTILL GOOD EATING HABITS. IT IS EASY TO CONFUSE A SUPER DOUGHNUT WITH A PLAIN OLD SWEETROLL, WHICH IN FACT IS THE SAME WITH THE EXCEPTION OF A HANDFUL OF VITAMINS.

ELIMINATION OF THE BREAKFAST BAR PROGRAM HAS MET WITH RESISTENCE FROM THE PEOPLE WHO PRODUCE THEM AND STAND TO LOOSE MONEY AND JOBS IF THE BAN IS ENACTED. SOME OF THE PEOPLE THAT WILL BE HURT FROM SUCH ACTION ARE THE INNER-CITY MINORITY GROUPS EMPLOYED BY THE BAKERIES. OTHER RESISTERS INSIST THAT THE CHILDREN WHO RECEIVE THE SUPER DOUGHNUT AND MILK FOR BREAKFAST WOULD OTHERWISE RECEIVE NOTHING AT ALL FOR BREAKFAST. THIS MEANS HUNDREDS OF THOUSANDS OF CHILDREN DAILY, A MAJORITY OF WHICH ARE INNER-CITY CHILDREN.

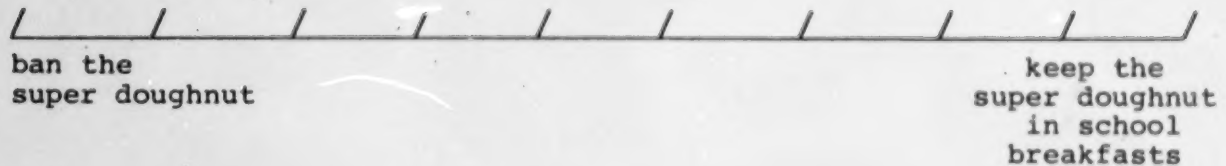
SCHOOLS WHICH PARTICIPATE IN THE BREAKFAST PROGRAMS ARE ENTITLED TO RECEIVE FEDERAL REIMBURSEMENT FOR THEIR MEALS PROVIDED THE MEALS MEET MINIMUM GUIDELINES. THE REQUIREMENTS ARE MILK, GRAIN, AND FRUIT. WHEN THE BREAKFAST BARS ARE SERVED WITH A CARTON OF MILK, THEY MEET THE FEDERAL REQUIREMENTS.

SHOULD THE SUPER DOUGHNUT BE BANNED?

DIRECTIONS

1. WORKING WITH A SMALL GROUP, BRAINSTORM A LIST OF EVERY ALTERNATIVE SOLUTION YOU CAN THINK OF.

2. WHERE DO YOU STAND ON THE CONTINUUM?



3. CONSEQUENCE SEARCH

AT THE TOP OF THE GRID, RANK THE THREE BEST SOLUTIONS THAT HAVE BEEN DEVELOPED BY YOUR GROUP. FOR EACH OF THESE THREE SOLUTIONS LIST ALL OF THE THINGS THAT MIGHT HAPPEN AS A RESULT OF YOUR DECISION.

SOLUTION #1

SOLUTION #2

SOLUTION #3

613

What's To Be Done

Curriculum Topic

HEALTH, DRUGS, POLLUTION

Subject

Science

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

6 - 8

Site

Classroom

Skills

Author

Thomas J. Kotulski

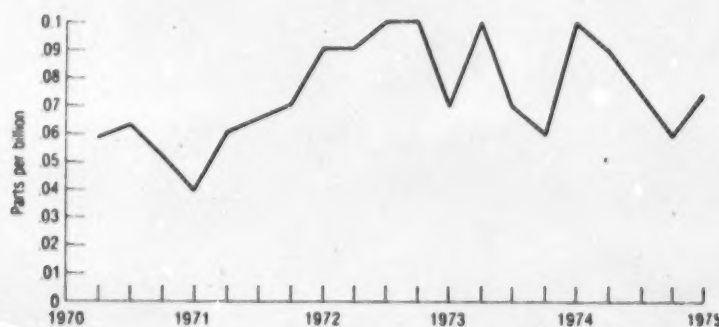
Objective

Students will be able to:

1. investigate an environmental dilemma,
2. identify the variables, discuss critically possible solutions and make a decision.

To The Teacher

Many technological successes, new inventions and advances begat environmental disaster (e.g. DDT, the car, nuclear power). In this activity students will be given the opportunity to make studies of the variables, pros and cons of a simulated technological advance. The lesson is designed to illustrate the principle concerning the fact that people are not above the natural world, rather are bound ever so intimately to it. Our survival and that of all life depends upon humankind developing an attitude of stewardship toward the environment in all its diversity and balance. Mercury Levels in U.S. Surface Waters, 1970-74



Source: Environmental Protection Agency, STORET.

In this activity, mercury is added to the environment. It has been proven that mercury is linked to birth defects and physiological disorders. The coastal area of Japan, in the 1950's, particularly Minamata Bay, was the site of mercury waste dumping. Soon cats began to lose muscle tone, visual acuity, and became mentally "dull". The same disease began to occur in the Bay's people. Mercury ingested from the fish of the Bay was the culprit.

A few comments on the techniques used in this activity are in order:

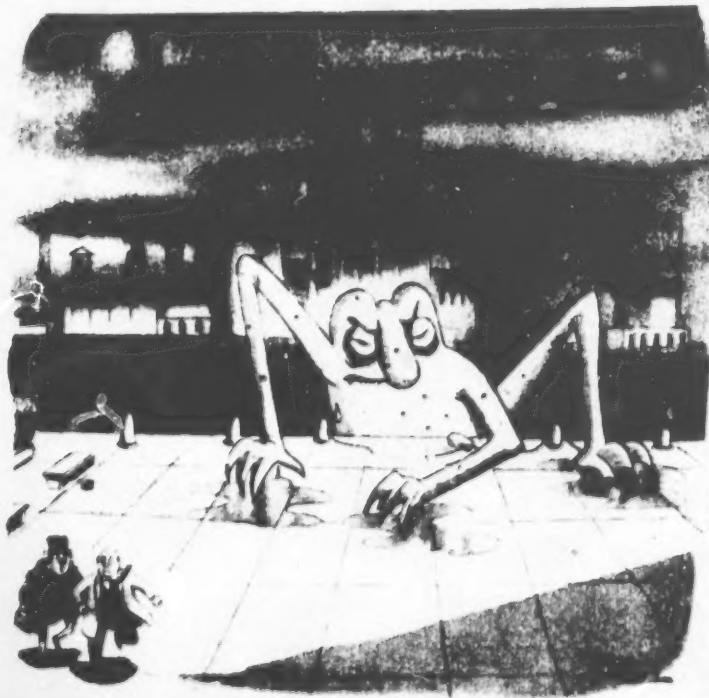
Alternatives Search - The teacher states a value-laden problem such as 'what to do about mercury wastes' or 'things to do to improve the playground environment', and asks students to individually brainstorm solutions to the problem (three to five minutes). Students then, in groups of three or four, combine individual lists, add new solutions and choose the three alternatives they like best and rank order these (in about ten minutes). Groups report results to the class.

Continuum - The teacher draws a long line on the board. The teacher and the class determine two polar positions on an issue. The positions are placed at the opposite ends of the line, and a series of points are marked along the continuum. The teacher whips around the room, asking students to tell where they stand on the issue, briefly describing the position. After five to ten students respond, everyone determines his or her own position.

Before You Begin

Caution: Brainstorming should be done without any criticism of another's idea.

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The New Yorker
Magazine, Inc.



"Now maybe they'll be moved to do something about water pollution!"

ACTIVITY

1. Pass out copies of Student Page to each student.
2. Divide the class into groups of 3-4.
3. Have the students read the situation, at the top of the Student Page.
4. Have each group brainstorm a list of alternative solutions. It is important to remind groups that every idea should be recorded no matter how outrageous it initially appears.
5. After allowing ten minutes for brainstorming, as a class make a master list of all potential solutions on the blackboard.
6. Ask each student to place themselves on the continuum on their worksheet from closing the plant to allowing it to stay open. There is not a neutral position.
7. Ask for a few volunteers to identify where they placed themselves on the continuum and explain their placement.
8. Continue with Step #3 of Student Page. Have each group select three of the most feasible solutions from their brainstorming list on the blackboard. For each of the three alternatives selected, have the group list as many consequences, both positive and negative, of their proposed solutions.
9. As a class, have each group propose a solution and present the consequences of their proposal. Encourage class discussion. Special attention should be directed to whether or not the consequences list is realistic and complete.

Related Activities

1. Investigate the link between mercury and birth defects and other diseases.
2. Investigate the link between lead in the environment and disease. What are the uses of lead? What were the consequences of reducing lead in paint or automotive fuel in order to reduce lead in the environment?

Resources

Simon, Sidney, Value Clarification, Hart Publishing Co., Inc., New York.

Credit

Jane Hart, teaching specialist, Environmental Education Center, ACES

STUDENT PAGE

WHAT'S TO BE DONE

A MAJORITY OF WORKERS IN A SMALL LAKE-FRONT COMMUNITY ARE DEPENDENT ON A SINGLE PHARMACEUTICAL PLANT FOR THEIR EMPLOYMENT. THE FACTORY PRODUCES AN EXPERIMENTAL CANCER DRUG THAT HAS SHOWN GREAT PROMISE IN CURING THIS DISEASE.

UNFORTUNATELY, THE RUN-OFF WASTES FROM THIS INDUSTRY ARE DISCOVERED TO BE THE CASE OF DANGEROUSLY HIGH LEVELS OF METAL MERCURY WASTES. MANY SURROUNDING COMMUNITIES WILL LOSE A MAJOR SOURCE OF THEIR NATURAL FRESH DRINKING WATER SUPPLY. THOUGH RESEARCHERS ARE WORKING ON IT, TO DATE, NO WAY HAS BEEN FOUND TO REMOVE THESE CONTAMINANTS FROM THE WASTE WATER THE PLANT DUMPS.

WHAT DO YOU THINK SHOULD BE DONE?

1. WORKING WITH A SMALL GROUP, BRAINSTORM A LIST OF EVERY ALTERNATIVE SOLUTION YOU CAN THINK OF.

2. WHERE DO YOU STAND ON THE CONTINUUM?

CLOSE THE PLANT

ALLOW THE PLANT TO STAY OPEN

- ### 3. CONSEQUENCES SEARCH

AT THE TOP OF THE GRID, PLACE THE THREE MOST FEASIBLE SOLUTIONS THAT HAVE BEEN DEVELOPED IN #1. THEN FOR EACH OF THESE THREE ALTERNATIVES, LIST AS MANY CONSEQUENCES AS YOU CAN THINK OF.

ALTERNATIVE #1

ALTERNATIVE #2

ALTERNATIVE #3

617

Dam Blockers? Endangered Species vs Social Needs

Curriculum Topic

BIOLOGY

Subject

Science

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

7 - 8

Site

Classroom

Skills

Reading

Identifying Consequences of
Alternatives

Author

Paul Kubicza

Objective

The student will be able to:

1. analyze the effects of human activities on endangered species
2. discuss critically whether laws should be implemented to ensure the survival of selected or endangered species.

To The Teacher

Today there are more than 1,000 species considered to be threatened by extinction, some imminently, some within a decade or so. More than 100 of these species are native to the United States.

Human activities present a number of dangers to wildlife. These include hunting, poaching, zoos, pet trade, inadvertent destruction of habitat, scientific experiment on animals and chemical control of pests with insecticides and herbicides. The major threat to animals today, however, is the destruction of the areas in which they live as a result of the expansion of growing human population.

The Endangered Species Act of 1973 authorized preparation of a list of "threatened" species (those not in danger of extinction in 1973, but likely to become so) and gave the Federal government power to protect these species. It provided the means by which a species could be designated as endangered or threatened. It further prohibited federal action that would damage habitat deemed vitally necessary to an endangered or threatened species.

In January, 1977, a Federal Appeals Court ordered work to be stopped on the Tennessee Valley Authority's Tellico Dam on the little Tennessee River. The court said that the dam would destroy the only known habitat of the 3-inch snail-eating fish called the snail-darter. Completion of the dam would be in violation of the 1973 Endangered Species Act.

The TVA, with \$103 million already spent on the project, is predictably unwilling to let the matter rest. Not only environmentalists, but many others, now fear that the Tellico controversy will trigger a congressional reassessment which could culminate in a weakened remodeling of the act.

In July, 1978, the U.S. Senate, by a 93-4 vote, passed an amendment to The Endangered Species Act of 1973 which would create a new review committee with representatives from seven Federal agencies and would empower this committee to grant exemptions from the 1973 Act itself for some Federal construction projects. The committee could permit the construction of a project that would destroy a species of animal or plant life if the benefits of the project "clearly outweigh[ed]" the value of the species.

Before You Begin

Prepare classroom copies of "Endangered Species vs. Social Needs", in Science World, January 12, 1978.

Words To Know

endangered species, extinct, habitat, species, biological chains



Conservation News 10-15-75 ⁶¹⁹

ACTIVITY

1. Pass out copies of the article "Endangered Species vs. Social Needs" to the class.
2. Ask class to read the article silently or take turns reading it aloud.
3. Discuss the article with your class. The following questions may be of value:
 - a) What does the Endangered Species Act of 1973 state?
 - b) Who passed the Endangered Species Act?
 - c) What happened in Maine during the summer of 1976?
 - d) What benefits would the dam provide for people in Maine?
 - e) What happened in January, 1977 on the Little Tennessee River?
 - f) What benefits would the dam provide for the people of Tennessee?
 - g) What benefits do the furbish lousewort and snail and snail-darter have for man? How are they important in the scheme of Nature?
 - h) Might the furbish lousewort and snail darter have benefits to man not yet discovered?
 - i) Does the human population have the right to bring a species to extinction as a result of human activities?
 - j) Do we have the right to bring a species to extinction by an act that will benefit millions of people?
 - k) What chain of events might be precipitated by the indiscriminate hunting and extinction of whales?
 - l) Are whales important to people? Why or why not?
 - m) Do you feel that laws in the future should become more or less strict in the preservation of endangered species?
 - n) If one of your parents were working on a dam project, would you want the construction stopped to save an endangered species?

Related Activities

1. Ask students to take a survey of other students and adults to gather opinions on the dam-building controversy.
2. Send to the National Wildlife Federation, 1412 16th St. N.W., Washington, D.C. 20036, for copies of "Endangered and Threatened Animal Species and Subspecies of the U.S."
3. Have students learn the endangered species laws of other countries.
4. Assign students to learn what U.S. organizations protect our threatened species.
5. Discuss with students what human activities can harm or threaten endangered species.

Resources

"Endangered Species of the United States", National Wildlife Federation, Washington, D.C.

Holden, Constance, "Endangered Species: Review of Law Triggered by Tellico Impasse", Science, June, 1977, pp 1426-1428

"List, By Class, of Endangered and Threatened Animal Species of the U.S.", National Wildlife Federation, Washington, D.C.

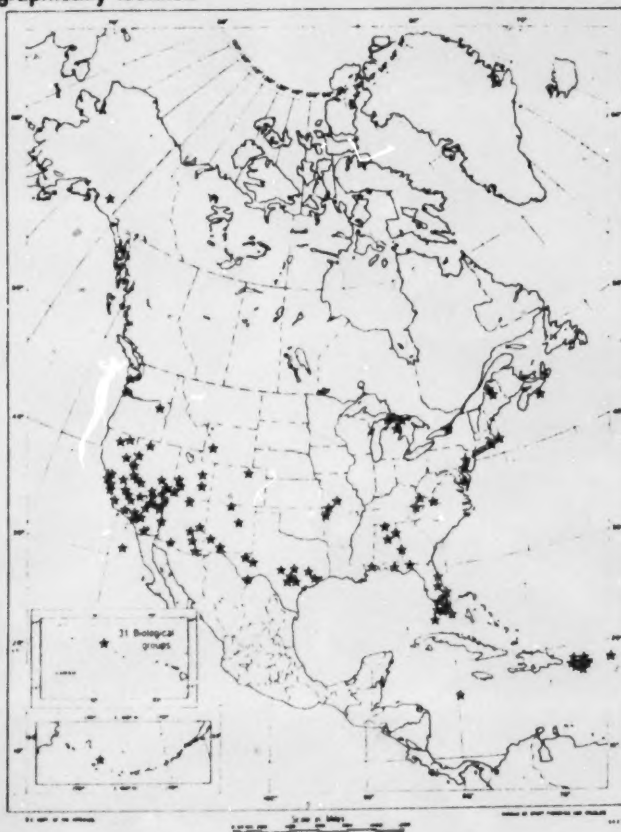
Shabecoff, Philip, "New Battles Over Endangered Species", New York Times, June 4, 1978, pp 38-44

Credit

Sherman, Kay, "Endangered Species vs. Social Needs", Science World, January 12, 1978, pp 4-6

Notes To Myself

Distribution of Endangered Species That Are Geographically Isolated



Source: Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior,
"Final Environmental Statement for the Proposed Endangered Species
Conservation Act of 1973," August 7, 1973.

STUDENT PAGE

ENDANGERED SPECIES VERSUS PEOPLE'S NEEDS

BY KAY SHERMAN
FROM SCIENCE WORLD, JANUARY 12, 1978

Summer 1976: Richard Gardner, a University of Maine botanist, finds several furbish louseworts near the site of a proposed \$600 million dam in norther Maine. The furbish lousewort is a kind of snapdragon that was thought to be extinct. Now, the flower will probably be added to the endangered species list. And that may block a major energy project!

Why?

If the dam were built it would convert water power into electricity for the area and it would also flood the flower's only known habitat. Since it is illegal to destroy an endangered species, Gardner's discovery could stop the dam from being built.

January 1977: Construction of the Tellico hydroelectric dam on the Little Tennessee River is 90 per cent completed. But a U.S. Court rules that the Tennessee Valley Authority (TVA) must stop construction. Why? The dam would flood and destroy the last habitat of the tiny snail-darter, an endangered fish species.

From Maine to Tennessee, two cases...two "showdowns" between endangered species and energy needs are taking place. And for the moment, at least, it seems the flower and fish have won.

All our endangered species are protected by the 1973 Endangered Species Act. That law says, among other things, that no U.S. government agency can build or fund a project that would destroy the only habitat of any endangered species. So, according to that law, the two dams cannot be used.

In the last several years, hundreds of situations like these have been brought to the U.S. Fish and Wildlife Service. In the majority of cases, the agency has worked out a way for the project -- a dam, highway or generator to be built without threatening an endangered species.

But some people think we are being forced to give up too much to save a few species. The TVA argues that a lot of money has already been spent on the Tellico dam. Roads and bridges have been built. And the industrial site planned for the area would provide jobs for many people. TVA officials think that the snail-darter case could be the first of many that might halt our country's development.

The Army Corps of Engineers (ACE) is still hoping to build the dam in Maine that's presently blocked by the furbish louseworts.

An ACE spokesperson says that if one of their projects were to destroy the last habitat of, say, the bald eagle, then it would make sense to stop the project. But the case of the furbish lousewort is a different story, says Brigadier General Drake Wilson of the ACE. He says "the discovery of a few clumps of greenish-yellow flower...a downright silly reason" to halt construction of the dam in Maine.

STUDENT PAGE, CONT'D.

Is our concern for wildlife getting out of hand? Tuna fishermen in California would probably say so. The fishermen rely on certain types of dolphins to locate schools of yellowfin tuna. Frequently, dolphins become entangled in the tuna seines (nets) and die. So, the fishermen are now required by law to hold down the number of dolphins that are killed. (See "To Save a Dolphin", Science World, 10/6/77.)

Some conservationists want the law to state that no dolphins can be killed.

That would be fine for the dolphins. But it would not be fine for the fishermen, canners, and salespeople who make a living in the tuna industry. What's more, tuna is an important and inexpensive source of protein for people all over the world. Therefore, the tuna industry is of great value to many people. But, how much is a dolphin worth? For that matter, how much is a snail-darter worth?... or a furbish lousewort?

Should a fish or a flower be allowed to hold up "progress"? How important is any species?

The answer is...very important! We---and all forms of life---are dependent on all other forms of life. Each and every species fits into complex relationships with other species known as biological or ecological chains. So, every species is dependent on others for food and oxygen. Green plants, for example, obtain energy from sunlight, the soil's chemicals, and water. We couldn't survive without the oxygen green plants produce. And most things we eat are either plants, or animals which feed on plants. If any species were to disappear, the balance of nature, and the environment, could be affected.

Consider the role of whales in their ocean environment. Most whales feed on krill, tiny ocean animals. In turn, krill feed on one-celled ocean plants known as phytoplankton. (Like all plants, phytoplankton give off oxygen.) Scientists estimate that before the 20th century, whale herds in the Antarctic ate about 150 million tons of krill a day. But, large-scale hunting has greatly diminished the whale population. So now whales consume far less krill. Without whales, scientists believe, the balance of plants, animals and oxygen in the ocean will be upset. A decrease in whales can mean an increase in krill. And since an increase in krill may lead to a decrease in phytoplankton, this may have an effect on oxygen levels in the atmosphere. Already, the well-being of ocean life may be threatened.

Scientists don't understand exactly how all the biological chains work. While a small flower may not seem important, we don't know what other plants and animals would be affected if that plant were to disappear.

All species are also important to us because we can learn from them. Studies of the different characteristics of living things---their adaptations for survival, their physical structure, their diet---often have applications to human life. For example, scientists study the whales' use of sonar to learn more about human hearing.

STUDENT PAGE, CONT'D.

Extracts from certain plants and animals are used to make medications and other useful substances. For instance, scientists have found ways to obtain gasoline-like substances from a desert shrub. And the great apes---orangutans, gorillas and chimpanzees---have been found to be suitable "stand-ins" for humans in many medical research tests.

Since no one can predict the discoveries we will make about other plant and animal species, it's too risky to wipe out any one of them. If we were to lose any species, we could be losing a very important source of information---forever.

In the cases of the furbish lousewort and snail-darter, the size and unfamiliarity of the species may have confused the issue. Many people wonder how such a small flower or fish could be important. But if the size of an object were a measure of its importance, then we probably never would have heard of DNA!

Each year, we find we need more energy to heat and light our homes, run our appliances and automobiles, and power our factories.

And each year, more plants and animals are threatened with extinction because of human destruction of their habitat or food supply. Even now, the snail-darter population is dying out rapidly because the dam structure is preventing the fish from getting upstream to spawn.

In the short run, it may seem desirable to provide energy for areas in Maine and Tennessee, and save jobs for those in the tuna industry. But in the long run, saving the environment by preserving the balance of nature may be more important than our immediate energy or economic needs.

The U.S. government has been considering these points for the last several months. Last summer, members of Congress debated whether the Endangered Species Act should be changed. Some representatives think we should exclude specific species, such as the snail-darter, from the act. Others have proposed that certain types of government activities, including agricultural, defense and energy development projects, should be allowed to be built, even if the project would destroy the habitat of an endangered species.

So far, none of these proposals has been enacted into law. As we go to press, however, the Supreme Court is examining the snail-darter case. Their decision---whether they decide "for" the fish or "for" the dam---will probably have a large impact on future U.S. policy on endangered species.

Meanwhile, the debate continues: should we continue to protect all endangered species, no matter what the cost?

Wood You Believe

Curriculum Topic

ECOLOGY

Subject

Science

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

7 - 8

Site

Classroom

Skills

Gaining information
Communicating information
Critical thinking
Valuing

Author

Pat Perrella

Objective

Students will be able to identify ways in which forest products are an integral part of contemporary lifestyles.

To The Teacher

The forest industry, based on a major natural resource, provides goods which are integral parts of our country's economy and lifestyles. The continuing supply of non-essential and essential forest products depends upon the intelligent management of the forest resource. Management options and policies ultimately are influenced by consumer demand for products and services.

We have taken the abundance of forest products for granted for too long. Hopefully, our society will begin to decrease its impact on the forest through reuse, recycling, designing more energy-efficient products, and using forest practices which minimize environmental damage. This activity will be a success if your students begin to think about their lifestyles and choices in terms of how energy efficient they are.

Before You Begin

Obtain catalogues from different department stores in your area.

Words To Know

renewable resource, non-renewable resource

ACTIVITY

PART I

1. Allow 15 minutes for students to list ways that they use paper or forest products within one week's time.
2. Ask students to draw a line through items on their lists which are least important to them and to circle three items which they consider to be most important.
3. Next to each of the three top priority items, ask students to write down a product or material which could be substituted for it, (e.g., instead of using paper to record information, use a tape recorder).
4. After an appropriate time for contemplation, lead a discussion on the comparative merits of the proposed alternatives considering the following factors:
 - a. whether the substitute serves the same purpose as efficiently and economically
 - b. whether the substitute is made from a renewable or non-renewable raw material
 - c. whether the substitute will require more or less energy to produce than the original forest product.

PART II

1. Organize a wood-finding search through the mail order catalogues of various department stores. Divide the class into groups of 3 or 4.
2. Distribute catalogues and survey sheet which list wood products, cost per item, whether the item represents a survival need, whether the item is wasteful and possible substitutes.
3. Lead a discussion on students' findings. The following questions are suggested:
 - a. How would your lifestyle be changed if forest products suddenly became unavailable?
 - b. How do you decide if something is a basic survival need or if it is something you want badly. Does everyone agree on the same items?
 - c. What factors might affect the supply and price of forest products? (population growth, forest management, lifestyles, forest health, etc.)

Related Activities

Ask students to brainstorm a list of forest products used in these specific areas of the home: kitchen, living areas, maintenance, exterior.

Resources

Project Learning Tree, Education/Research Systems, Inc., 1977, pp 19-20

STUDENT PAGE

SURVEY SHEET

DIRECTIONS: RECORD AS MANY ITEMS AS YOU CAN FROM THE CATALOGUE WHICH USE WOOD OR PAPER OR OTHER FOREST PRODUCTS. FILL IN THE REMAINING INFORMATION BY LISTING THE PRICE OF EACH ITEM, WHETHER IT IS A BASIC SURVIVAL NEED, WHETHER YOU FEEL IT IS WASTEFUL, AND ANY SUBSTITUTE YOU CAN THINK OF FOR THE ITEM.

ITEM	PRICE	Is IT A SURVIVAL NEED?	Do YOU FEEL IT IS WASTEFUL?	SUBSTITUTE

Graphing Whale Data

Curriculum Topic

MATHEMATICS

Subject

Math, Social Studies

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

6-8

Site

Class

Skills

Communication skills,
graphing data

Author

Cyndi Walsh

Objective

The student will be able to:

1. use reference tables and interpret data in a graph form.

To The Teacher

The following graphing exercises are self-exploratory. Content deals with whaling data reported by the International Whaling Commission. Activities will compliment social studies and science units and will infuse environmental education into a math curriculum.

Before You Begin

Materials: graph paper, pencils

- Preparation:
1. Duplicate Student Information Sheet.
 2. Duplicate or make transparencies of Charts 1, 2 and 3.

Words To Know

humpback

ACTIVITY

1. Distribute Student Information Sheets and read aloud.
2. Distribute Charts 1, 2 and 3.
3. Assign the graphing exercises to be done independently or in small groups.
4. Give graphing directions for Chart #1:

A quota system was used to protect the humpback whale as early as 1946. Using the information on Chart 1, make a table to indicate the number of whales killed over the limit each year. (i.e. # Killed - Quota = Excess)

Example:	Year	# Killed	Quota	Excess
	1946	2117	1250	860

After completing the table use a line segment graph to show the yearly rise and fall of the excess humpback whales which have been killed.

5. Give graphing directions for Chart #2:

Using Chart #2, make a circle graph to picture how the different parts of the total are related. Like cutting a pie, show the pieces of different sizes to indicate which parts of the total are greatest (Japan 42.8% of the pie) and which parts are smallest (USA .5% of the pie). The pie in this case is the total amount of whales killed from 1967 to 1968.

6. Give graphing directions for Chart #3:

Using Chart #3, make a pictograph to show the quantity of whale, beef, pork, chicken and meat production. Use symbols to show the relationships, but not so many symbols that the graph will be too large. For example, if the greatest quantity listed is 755 thousand tons, use one symbol for each 100 tons. The greatest quantity then can be represented by 7.5 or 7-1/2 symbols and the smallest quantity will also be well represented.

Related Activities

1. Write to whaling countries (e.g. Russia and Japan) to protest.
2. Explore the impact of boycotting the products of whaling countries.
3. Research the Green Peace (Save the Whale) movement.

Resources

Whalebook, Conservation Manual Endangered Species Production, Boston, MA, 1974, EEC # 726.

Connecticut Whale Book, Teacher Resource Guide, Connecticut Cetacean Society, 1976, EEC # 704.1

STUDENT PAGE

STUDENT INFORMATION SHEET

THE PURPOSE OF THE INTERNATIONAL WHALING COMMISSION, INITIATED DECEMBER 2, 1946, WAS TO REGULATE WHALING AS A WORLD-WIDE INDUSTRY. CONCERNED WITH THE DECLINE OF THE WHALING INDUSTRY AND CONSERVATION OF WHALES, 17 NATIONS FORMED THE COMMISSION. REPRESENTATIVES FROM THE NATIONS AGREED TO BE RESPONSIBLE FOR THE COMPLIANCE OF THEIR COUNTRIES WITH THE DECISIONS OF THE GROUP. SADLY, INSPECTION OR ENFORCEMENT OF DECISIONS WAS DIFFICULT. BEGINNING IN 1963, THE COMMISSION REPEATEDLY SUGGESTED STRICT HARVEST QUOTAS, BUT THEIR ADVICE WENT UNHEEDED. AS THE ENDANGERED STATUS OF THE WHALES BECAME MORE EVIDENT, MANY COUNTRIES CURTAILED EXCESSIVE KILLING BY ADHERING TO THE REGULATIONS OUTLINED BY I.W.C. HOWEVER, EXCESSIVE OVERKILLS HAVE GROWN IN NUMBER DESPITE THE PRESENT BAN ON WHALING.

THE FOLLOWING GRAPHING EXERCISES WILL SHOW THE SOMEWHAT FUTILE ATTEMPTS MADE BY THE I.W.C. TO PROTECT THE DWINDLING WHALE POPULATIONS OF THE WORLD.

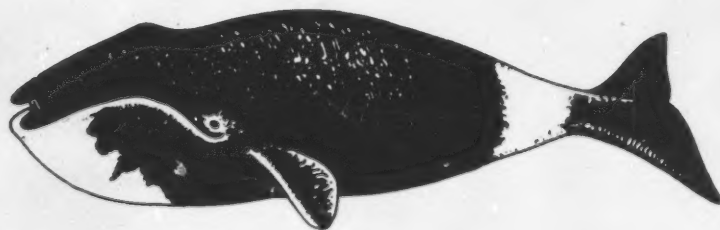


CHART 1

THE IWC SCORE ON THE HUMPBACK WHALE

- 1946 None to be taken in the Antarctic; "stocks too low."
- 1949 Antarctic humpback ban relaxed, catch limit of 1250 set. 2117 taken.
- 1950 Quota set at 1250; 1630 taken.
- 1951 Quota set at 1250; 1545 taken.
- 1952 Humpback season shortened in view of declining stocks. 949 taken.
- 1953 Scientific Committee urges 3-day humpback season because of low stocks. 4-day season set. 594 taken.
- 1954 Scientific Committee recommends complete protection of humpbacks. Hunting banned in part of North Atlantic; no restrictions in North Pacific. 493 taken.
- 1955 Kill of humpbacks: 1432.
- 1956 No action. 3196 taken.
- 1957 Scientific Committee could not prove humpback stocks had improved, but season was lengthened to reduce pressure on fin whales. 2923 taken.
- 1958 Ban on humpbacks in North Atlantic extended 5 years, area of protection reduced. 5055 slaughtered.
- 1959 No action. 3576 killed.
- 1960 Scientific Committee recommends a complete rest for humpbacks for 10-12 years in southern oceans and total ban in Antarctic. No quotas set. 2840 killed.
- 1961 No quotas set. 2436 taken.
- 1962 Attempts to protect humpbacks blocked. 2758 taken.
- 1963 Complete ban on humpback fishery in Southern Hemisphere passed. 318 taken.
- 1964 5-year ban in North Atlantic. No Antarctic catch limit. 452 killed.
- 1965 Ban in North Pacific for one year. 59 killed.
- 1966 One-year protection ban extended one more year, amounting to almost total protection. 4 taken.
- 1967 North Pacific ban extended for three years. 2 taken.
- 1968 Ban in effect. 5 taken.
- 1969 Ban in effect. 15 taken.
- 1970 Ban in effect. 24 taken, 20 under special permit.
- 1971 Ban in effect.
- 1972 Humpbacks accorded complete protection everywhere indefinitely. Considered commercially extinct. Estimates of 7000-8000 individual whales left.

"Seriously depleted throughout its range, principally in the present century. It has been accorded world-wide protection since 1966. At the present time there is little evidence of a recovery of stocks except in the north-west Atlantic."

"Humpback Whale," The Red Data Book, IUCN 1973.

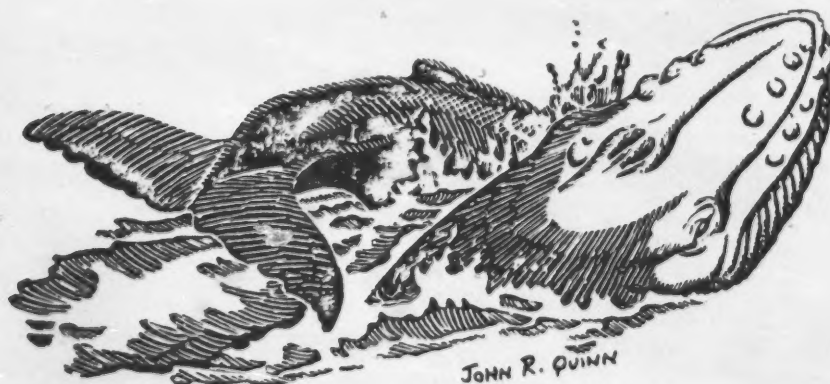


CHART 2

WHALES KILLED BY COUNTRY - ABSOLUTE & PERCENTAGE FIGURES

	1967/68		1968/69		1969/70		1970/71	
	No.	%	No.	%	No.	%	No.	%
All countries	46,645	100.0	41,872	100.0	42,254	100.0	37,890 ¹⁾	100.0
Australia	658	1.4	679	1.6	799	1.9	860	2.2
Brazil	103	0.2	137 ²⁾	0.3	102	0.3	75 ³⁾	0.2
Canada	804	1.7	695	1.7	712	1.7	710	1.9
Chile	N. A.		N. A.		103	0.2	253	0.7
Denmark	12	-						
Iceland	280	0.6	423	1.0	377	0.9	554	1.5
Japan	20,163	43.2	17,128	40.9	17,047	40.4	15,512	40.9
Norway	1,183	2.5	128	0.3	228	0.5	226	0.6
Peru	2,462	5.3	2,305	5.5	1,935	4.6	1,773	4.7
Portugal	149	0.3	228	0.5	249	0.6	353	0.9
Spain	359	0.8	315	0.8	413	0.9	N. A.	
South Africa	1,301	2.8	2,078	5.0	1,880	4.4	2,143 ⁴⁾	5.7
USA	202	0.5	183	0.4	73	0.2	53	0.1
USSR	18,969	40.7	17,573	42.0	18,336	43.4	15,373	40.6

1) Includes Greenland, 5 whales.

2) In addition, 701 Minke whales.

3) In addition, 900 Minke whales.

4) In addition, 204 Minke whales.

Source: Bureau of International Whaling Statistics, Sandefjord, Norway.

CHART 3

The following table shows the recent increases in Japanese meat production and the steadily decreasing production of whale meat by comparison.

Animal Meat Production in Japan (1,000 tons)									
Year	Beef	Horse	Pork	Lamb/ Goat	Rabbit	Chicken	Whale (B)	Total (A)	B/A%
1966	152	11	542	1	1	261	185	1,153	16.0
1967	148	13	546	2	1	303	172	1,185	14.5
1968	172	14	511	1	1	336	156	1,191	13.0
1969	230	11	526	1	1	423	156	1,348	11.6
1970	265	10	691	1	1	505	153	1,626	9.4
1971	279		755	11		571	125	1,741	7.1

Source: Japanese Food Supply & Demand Table (Imports are not included).

Texture Walk

Curriculum Topic

LANGUAGE ARTS

Subject

English

Environmental Topic

ENVIRONMENTAL ETHICS

Grade Level(s)

6, 7

Site

Schoolgrounds

Skills

Observing
Collecting
Writing

Author

Carla McGeeney

Objective

The students will be able to:

1. describe textures in nature in terms of evoking moods or feelings

To The Teacher

Texture is the surface character of an object. The visual appearance and feel of a surface reveal an object's structure, form, composition and grain. Different textures often evoke different moods or responses from the viewer. Too often, we are not aware of the feelings that certain textures give us. This exercise is useful in developing an understanding of various textures and words to describe them. In addition, students will increase their sensitivity to the world around them.

Before You Begin

Caution: Caution the students not to pick plants, but rather to choose inanimate objects such as fallen leaves, broken branches, etc. Have students carry along a litter bag to pick up trash while they look for textured objects.

This is a good time to bring out the concept of people as "stewards" rather than exploiters of the earth.

Materials: paper, writing surface, pencils, copy of texture list for each student (attached)

Words To Know

texture, environment, animate, inanimate

ACTIVITY

1. Give students copies of texture list.
2. Each student will gather items to represent at least 10 adjectives on the texture list.
3. While sitting near the area where they found a specific item, students will write an explanation of why the item represents to them a certain texture.
4. Display the objects and written explanations where others may enjoy them.

Related Activities

Translate written explanations into haiku. (See "One-Breath Poems" by P. Perella in this notebook).

Notes To Myself

STUDENT PAGE

DIRECTIONS: FIND OBJECTS WITH TEXTURES WHICH REPRESENT THE ADJECTIVE OR MAKE YOU FEEL AS THE ADJECTIVE DESCRIBES. USE AT LEAST TEN ADJECTIVES.

BLUE
HAPPY
LIVING OR ALIVE
SAD
QUIET
PEACEFUL
COLD
DEAD
LOVING
HATEFUL

POROUS
HUMAN-MADE
VERY NEW
DULL
SHINY
SMALL
CREEPY
OLD
BUMPY
SMOOTH

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TAXONOMY OF SKILLS

I. BASIC SKILLS -

Reading
Writing
Computing
Listening
Speaking
Analyzing

II. ACQUISITION AND/OR VERIFICATION OF INFORMATION

A. Information Skills

1. Locating and obtaining information (reading, listening, or observing).
2. Organizing information
3. Using information for a purpose
4. Communicating information (orally or in written form)
5. Evaluating information

B. Data Skills

1. Collecting and compiling data
2. Interpreting data
3. Infering from data
4. Graphing data
5. Mapping data
6. Measuring
7. Constructing hypothesis
8. Testing hypothesis
9. Predicting

III. PROBLEM-SOLVING SKILLS

Listening with comprehension

Recognizing problems

Defining problems

Locating and obtaining information

Organizing information

Analyzing information

Generating alternative solutions

Developing a plan of action

IV. VALUING SKILLS

Identifying alternatives

Identifying consequences of alternatives

Identifying feelings about alternatives

Choosing freely

V. OTHER SKILLS

Classifying

Observing

Experimenting

Concluding

Constructing models

Reading maps

Interpreting maps

Brainstorming

Implementing

Intuiting

VI. PERSONAL SKILLS

Developing self confidence

VII. GROUP SKILLS

VIII. CITIZENSHIP SKILLS

EARTHWATCH Activity Feedback Form

Activity _____ Leader _____
 Age Level _____ No. of Children _____ Position _____
 Activity Site: _____ Address _____

Approx. minutes spent on activity _____

COMMENTS _____

	YES				NO
1. I had a lot to explain before starting the Activity.	5	4	3	2	1
2. Background information was just what I needed.	5	4	3	2	1
3. Instructions were easy to follow.	5	4	3	2	1
4. Children were interested.	5	4	3	2	1
5. Suggested discussion questions worked well.	5	4	3	2	1
6. How many of the "Related Activity" suggestions were used?	5	4	3	2	1
7. I will use this activity again.	5	4	3	2	1
8. Student Pages (if supplied) were useful.	5	4	3	2	1

Please describe, on the back of this card, any adaptations you made or improvements you suggest.

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